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CONTRIBUTIONS TO THE SYNANTHROPIC (ADVENTIVE) FLORA OF THE RAILROADS IN ST. LOUIS, MISSOURI, U.S.A.

Viktor Mühlenbach[1]

Abstract

Based on 563 excursions from 1954 to 1971, 393 synanthropes (adventive plants not native to the flora of Missouri) were discovered on the railroad network in St. Louis. The majority were weeds and escapes from cultivation. The plants belonged to 59 families. The best represented families were Gramineae (74), Compositae (52), and Cruciferae (28). During this study 129 new taxa to the flora of Missouri were discovered of which 39 taxa are reported for the first time in this paper. The results of this study are quite similar to comparable European studies. There was a preponderance of annuals (254 of 393); most species were rare (208 were deemed very rare—no more than 5 localities in 18 years); the majority of plants were ephemeral (47 were seen only once as a single plant, 52 were seen only as a single colony); and there is much fluctuation in the frequency of most species. Eighty-nine species were considered to be naturalized. Other characteristic features of these railroad plants were nanism and seed dormancy. It was not possible to determine the exact means of introduction for the great majority of synanthropes. Many synanthropes were found along classification or switching tracks in freight yards, fewer along trunk lines. The habitat preferences and gregarious behavior of various species is discussed. The most common synanthropes were: *Bromus tectorum, Digitaria sanguinalis, Setaria viridis, Kochia scoparia, Amaranthus retroflexus, Capsella bursa-pastoris, Melilotus officinalis* and *Convolvulus arvensis.* Native species were studied also, but in less detail. Some of the most common native species were: *Eragrostis pectinacea, Hordeum jubatum, Aristida oligantha, Lepidium virginicum, Euphorbia dentata, Erigeron canadensis, Ambrosia artemisifolia* and *Helianthus annuus.* The devastating effect of the extensive use of weed killers in modern railroad management on railroad plants is discussed.

Since 1954 I have been working on the adventive flora of the railroads of St. Louis. These studies followed similar studies in my native city, Riga, Latvia, where I observed the adventive flora of the railroads for 20 years (1924–1944). Results for the first half of this period (1924–1932) were published (Mühlenbach, 1927, 1932–1934). During these years 128 species were found which were not native to Latvia—they were introduced by the railroads. The extensive material collected during the second half of this period was lost during World War II, and remains unpublished.

The St. Louis metropolitan area has a railroad network that is the second largest in the United States. It seemed that a study of the presence, frequency, and ability to survive of introduced plants could be rewarding. The railroads

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[1] Missouri Botanical Garden, 2345 Tower Grove Avenue, St. Louis, Missouri 63110.

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in St. Louis have never been examined from the botanical point of view, and it soon became obvious after initiating my studies that very little is known about plant life on the railroads for the entire United States. It seems that American botanists have been much more interested in the study of roadside vegetation (see Frenkel, 1970, for a thorough treatment for California). In Europe, on the other hand, numerous papers on the flora and vegetation of railroads, especially the freight and switching yards, have been published. An extensive selection of newer papers on the subject is given by Hamann & Wagenitz (1970) in their bibliography for the *Flora von Mitteleuropa.* Such studies have probably been most thorough in Germany and Switzerland.

Railroads have frequently exerted a strong attraction to many people, and botanists have not been an exception. Experience in many countries has shown that one can easily find numerous rare plants along railroad tracks. My feelings are very much like those of the prolific author of adventive botany, Meyer (1932a), who calls the pursuit of railroad-yard floras one of the most fascinating studies in botany. However, for the sake of fairness, one must acknowledge that there are also opposite views. Müller (1935) writes: "Many botanists consider the pursuit of adventive plants of little value, even a useless waste of time."

Lehmann (1895), one of the first pioneers in railroad botany, called the freight and switching yards "botanical gardens of a kind." The comparison holds to a certain degree. In both places one may find a multitude of rare, strange, and unfamiliar plants; however, the way these plants are perceived and treated in these two places differs enormously. Whereas man exerts the best possible care of the plants in botanical gardens, he usually wages an embittered fight against the plants of the railroads. It is a pity to say that this fight has been constantly increasing in intensity and effectiveness in the last two decades. Another difference is that man, as a rule, brings plants to a botanical garden intentionally, while the plants on railroads move in on their own without the wish or even knowledge of man. These plants hitchhike, so to speak, becoming attached in one way or another to the freight or, in rare cases, the rolling stock of the trains.[2]

REVIEW OF LITERATURE

Linnaeus already recognized the role of trade and traffic in the dispersal of plants. Flygare (1768) in the *Amoenitates Academicae* discussed the dispersal of seed. Seven different means of dispersal were described, the last one being commerce. In Linnaeus's time two main ways existed for spreading seeds through commerce. Many goods might contain the fruits, seeds, or other parts of plants suitable for propagation. Agricultural products such as cereals, wool, cotton, and oil seeds are especially likely to contain such plant propagules as impurities. The second main way of spreading plants by commerce was through use of ballast by seagoing ships. Ballast often consisted of earth, rocks, or sand. This would often be shifted from one harbor to another as needed and the same material might easily travel to many different parts of the world. Considering the material most often used as ballast, it is no wonder that it often contained fruits, seeds, rhizomes, bulbs, etc. Consequently rich "ballast floras" frequently developed and many "ballast plants" were widely distributed in many countries.

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[2] Levina (1944) called this process agestochory (from the Greek—to convey or to transport by themselves).

In the United States, beginning in 1864, the flora of the harbor and its ballast grounds were examined especially carefully in Philadelphia, and on the opposite shore of the Delaware River in New Jersey. Extensive lists of introduced plants were published by Smith (1867), Martindale (1876), and Burk (1877). Smith discovered 106 introduced plants in 3 years and Burk added 125 more species. With even bigger success Brown (1878) began in 1877 to study the ballast flora of wharves and abandoned overgrown ballast grounds in the New York harbor, as well as in similar localities along the Hudson River in New Jersey. Brown's list contained 386, mostly European, species. He maintained that the large number of ballast plants was caused by the continued large balance of trade in favor of the United States. Therefore, many more ships unloaded ballast than took on ballast, thereby increasing the chance for adventive plants to establish themselves. It is very interesting that besides giving their lists, American botanists mentioned some features and pecularities of the ballast flora which were much later discovered anew and described by railroad botanists in Europe. Smith (1867) transplanted juvenile plants threatened by frost so that they could develop flowers and fruit in greenhouses. Burk (1877) observed that many plants exist only one season and then disappear. Brown (1878) observed that species that may remain for years often show strong fluctuations in their numbers from year to year. He also observed (Brown, 1881) that some plants often change their locality and explained their reappearance by newly introduced seeds. Seed dormancy was discovered to be a factor as well—many species suddenly appeared on grounds where ballast might have been deposited as much as four years previously. Fluctuation of species richness due to disturbance by man for business purposes was often an important factor in a ballast flora. Railroads were mentioned in these early ballast studies as well, but only because the ballast there was used as a fill for railroad tracks. No thought was given to the possibility that the railroads themselves might have been a source of introduction of inland plants.

In the second half of the 19th century, railroads began to develop. Also, ships began to use water instead of earth and sand as ballast. This procedure was cheaper, less time consuming, and considerably increased the cleanliness of the ships. It also meant the downfall of the ballast flora everywhere. However, the role of maritime commerce in the introduction of plants did not entirely cease. Transported freight continued to be a vehicle for transporting alien plants. Voyages which begin on a ship are mostly continued on railroads until a final destination point for the goods is reached. However, diaspores may easily escape in a harbor before further transport; therefore, many harbors, both coastal and inland, often contain a sizeable number of introduced plants.

From a botanical point of view, the most famous harbor is Port Juvenal near Montpellier in France. The history of adventive plants in the harbor began in the heyday of the ballast floras but continued into the 20th century. In 1813 de Candolle called the attention of botanists to this place, and many renowned botanists visited it. Thellung (1912, 1915) gave the description of botanical events in his doctoral thesis. The richness of the flora in alien plants was due to the wool washing establishments there. For a century wool from all over the world was imported and cleaned from impurities that included innumerable seeds and fruits equipped with barbed awns, hooked prickles, bristles, etc.

Thellung analyzed the previously published lists and found that beginning in 1815 Oriental plants were exclusively represented. A little later Algerian plants appeared. Around 1830 the first South American plants arrived, and in 1870 Australian plants appeared. It was thus possible to reconstruct the commercial history of the wool washing establishment from botanical observations. Many introduced plants were discovered and described before they became known in their native countries, and for some, the land of origin is still unknown. Thellung compiled a list containing 800 species—the majority being the wool adventives and most of the others being escaped cultivars.

Another very interesting book dealing with wool adventives was published by Hayward & Druce (1919) based on work from 1907 to 1918. Hayward scrupulously explored the banks of two rivers, Tweed and Gala, into which abundant effluents of woolen mills at Galashiels, Selkirk County, Scotland, were discharged. Other plants were collected from woolen mill refuse heaps and places where the refuse was used as a fertilizer. The writers mentioned the role of the railroad in transporting diaspores in wool but failed to realize that some wool adventives would also have been spread along the railroad itself.

Hayward and Druce enumerated 348 wool adventives and also listed introduced plants which arrived in other ways. Many wool adventives found at Galashiels were recorded for the first time in Europe, and new species were described with origins unknown. In comparison with Montpellier the percentage of Australian, Asiatic, South African and North American species was much higher. The writers emphasized that most of the wool adventives were ephemeral in the Scottish climate so that naturalization rarely took place.

In the beginning of the 20th century, some ballast grounds in the Baltimore harbor area were still present. C. C. Plitt frequently collected there in the years 1900 through 1904 and a partial record of his findings was given by Fessenden (1956). As usual, new species were found but many plants defied determination. In 1953 in Baltimore Reed (1964) begin to investigate the huge piles of chrome ore that were waiting delivery to steel mills. Altogether 536 species of flowering plants were collected, mostly on chrome-ore piles. Many species were natives, but the overwhelming majority were introduced. About 80% were new to Fernald's *Gray's Manual of Botany* or Gleason's *Illustrated Flora of the Northeastern United States and Canada.* There were many African species, particularly among the grasses, which is not surprising since Rhodesia and Ghana are major chrome ore exporting countries. A similar flora occurs in similar situations in the port of Newport News, Virginia and along seven miles of the Chesapeake & Ohio railroad from the harbor inland to where huge piles of different ores have been stocked by an ore refining company.

The botanical investigation of many islands which are accessible only by ships showed that the introduction of plants may play a very distinct, even fatal role for the native vegetation. The most famous example is the island of St.

Helena. The exceedingly interesting native flora of this island, which consisted mostly of endemics, was greatly reduced through competition from imported foreign plants and/or overgrazing from several domesticated animals. Good (1964) cited Melliss (1875) who noted that among 900 species of flowering plants on St. Helena only about 30 were really native. In the Western Hemisphere similar examples abound. For example, Harris (1965) estimated that on Antigua and Bermuda islands 180 out of about 900 flowering plants were introduced. Of course, part of the aliens were brought in deliberately as food crops or ornamentals, but numerous herbaceous weeds and grasses have spread into these islands after their accidental introduction. These examples prove that navigation has played and will continue to play an important role in the dispersal of plants and the introduction of aliens.

Approximately at the same time that the ballast flora began to decline, the era of railroad transportation on the continent began to develop. The first railroad with steam traction was inaugurated between Darlington and Stockton in England in 1825 and served only freight traffic. The first passenger line was also opened in England between Liverpool and Manchester a year later. In 1837 the first lines were opened in Germany and Belgium. In the 1840s railroad construction boomed all over Europe. Curiously, the role of the railroad in the introduction of alien plants was slow to be understood. This is evident from the numerous local floras that were being published by different German botanical and natural historical societies at that time. Rare plants were enumerated and railroad localities were often mentioned. Many plants in those localities were decidedly alien. Nevertheless, in the beginning it occurred to no one that there could be a connection between the railroad operations and the alien plants in the vicinity even though foreign grain, as well as wool, could arrive in most places only by train. Some papers of the famed P. Ascherson showed quite distinctly that it took a long time to solve the question. For example, in 1860 he described the discovery of *Sideritis montana* L. near Magdeburg in the vicinity of a railroad bridge on a moist bank of the Elbe River, together with *Alyssum montanum* L. and *Stachys annua* L. Ascherson attributed their occurrence to alluvium from the river. But as all three plants are inhabitants of dry, rocky habitats, he called this colony's habitat very surprising. No thought was given to the railroad bridge in the shadow of which the plants had grown. Many similar examples could be cited.

Perhaps the very first to unmistakably point to railroads as introducers of alien plants was Kreuzpointner (1876),[3] who accidentally discovered in the Thalkirchen railroad station near München a "great multitude" of rare plants growing around the municipal warehouses. He enumerated 84 species. In the warehouses immense amounts of Hungarian, Russian, and Italian grain were stored and partly cleaned. There was no doubt that the source of these aliens was the grain. Earlier (1862–1880) Holler made similar observations in Augsburg on a trunk line 25 km long, but he did not publish until 1883. He listed 44 species and recognized that they were introduced by grain transports. He also described some peculiarities which are still valid today. He noted that there was a distinct predilection of many aliens to grow either in the stations or along a trunk line which was double tracked. The aliens were mostly concentrated along the track on which the trains with grain shipments were routed. On the opposite track some aliens were also found, but of a different origin. The preferred location was in curves of the track. He also realized that some aliens were characteristically unicates.

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[3] It appeared for a while that another writer had described the role of railroads considerably earlier. Preuss (1928–1929) described the discovery by Eggemann (1859) of the first wool adventive, *Medicago intertexta* Willd., at a cloth factory at Haste near Osnabrück. According to Preuss, Eggemann stated that it was introduced with wool from Buenos Aires. After studying the original manuscript, it became clear that the sentence "the wool which the new railroad has brought in" was an addition by Preuss himself. Kreuzpointner must still be considered as the first who has clearly recognized and published the role of the railroad in plant introductions. After my manuscript went to press I returned to the German botanical literature preceding 1876 and discovered that several writers before Kreuzpointner pointed out the role of railroads in unintentional introduction of plants. The earliest paper now appears to be the one by Caflisch in 1848.

Soon afterwards numerous papers on railroad plants were published. Among this multitude of papers is one by Lehmann (1895; with supplement, 1896) of which the greater part is devoted to the local flora of one of the provinces of Latvia. The chapter on dispersal of plants by railroads was very significant to me for my treatment of the railroad flora in Riga, but, besides this, it contains many observations of general interest. The importance of this treatise was first stressed by another ingenious railroad botanist, Matthies (1925), who emphasized that "strangely enough a comprehensive treatment of this problem in the scientific literature is given in reality only by Lehmann." Lehmann was a physician who traveled extensively on railroads, using even freight trains. Finding the vegetation on the railroad right-of-ways very interesting, he began investigations in the big freight yards in Dünaburg (now Daugavpils). He concluded that it was very important to continuously observe the flora's immigration, perseverance, and disappearance. Lehmann distinguished between railroad plants in a broad and narrow sense. In a broad sense, railroad plants included those from the surroundings. Many native plants were brought in during the construction and maintenance of the embankments and slopes, especially in sod used for erosion control, causing many meadow plants to appear in unusual places. In a narrow sense, railroad plants were those imported or introduced from more or less remote distances. The invasion of railroad plants took place by ballast[4] and maintenance trains, by freight trains, and rarely by passenger trains. Ballast contributed much to the invasion of alien plants. After investigation of the flora of different sand and gravel pits from which the railroad took the ballast, Lehmann could in many cases reveal, to the surprise of officials, where the ballast originated.

Lehmann (1895, 1896) also noted that plants are generally dispersed by freight trains carrying grain. Such grain is never free from weed seeds, whether transported in sacks or in bulk. The small weed seeds which are usually heavier may sift through the grain and fall to the ground through cracks in the freight cars. Lehmann once observed this with flax, finding small sturdy specimens of flowering flax standing parallel to the rails for 2 km. Besides grain and flax, the transportation of all kinds of produce and livestock could be effective in distributing seeds.

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[4] Ballast as used here has nothing to do with ship ballast. Railroad ballast consisting of sand, grit, cinder, gravel, and crushed stones is intended to prevent the shifting of the cross-ties and to increase the solidity of the tracks.

Switching and freight yards and, to a lesser degree, trunk lines can yield a rich flora of adventives unless the railroad management is very tidy. In large freight yards there are usually little-used tracks with wide intervals between the tracks and open plots where weeding is not taken too seriously and where introduced seeds may flourish. Lehmann noted that the older the railroad, the larger the colonization by alien plants, especially of the subboreal type.

The dispersal of plants by passenger trains occurs when seeds arrive with the luggage or in the packing material of easily perishable goods which require shipping on more rapid passenger trains. The presence of an alien growing at that time as a frequent ornamental in gardens along a trunk line gave Lehmann the idea that it owed its existence to a discarded bouquet of flowers.

Lehmann (1895–1896) considered the difficult question of when one may claim naturalization of an introduced plant. Klinggräff (1866) had suggested that a period of 30 years should be demanded before a plant is considered naturalized. In many cases Lehmann believed such an interval to be unnecessarily long, but in other cases not long enough for actual naturalization.

Approximately at the same time, Huth (1895) described an unusual experiment done in the surroundings of a supply depot connected with a large military bakery and granary in Frankfurt-an-Oder. Here rye from southeastern Europe, Hungary, and South Russia was ground. The chaff left over after the cleaning of the rye was repeatedly scattered over four grass plots of the supply depot. For many years different adventives were found in these plots.

In the beginning of this century an intensive study of plant introduction was started by Thellung in Switzerland. In 1905 he published statistics which revealed how profoundly railroads, which were the only means of importing goods into Switzerland, had contributed to the introduction of adventives. He recorded 1,049 ruderal and adventive species in the canton of Zürich. In the Zürich station and nearby gravel pits alone, 769 species were recorded. Of these, 318 species were native to Zürich (apophytes), 104 species were escapes from cultivation (ergasiophygophytes), 150 species were naturalized in Zürich from foreign origin including prehistoric weeds (archaeophytes), and 196 species were transient (ephemerophytes). In 1911 Thellung noted that many Mediterranean and American species that were known to be naturalized in Australia were introduced into Switzerland from Australian wool. In 1919 he termed this phenomenon secondary introduction. In this same paper, he noted that many Mediterranean species were being introduced with hay that was used as the packing material for southern citrus fruits.

In 1905 Hesselman edited the paper of the late Swedish botanist Sternstroms who had compared both slopes of the embankments of one Norwegian and 11 Swedish railroads from the ecological point of view, noting the importance of unequal solar irradiation.

Zimmermann in 1907 published a book on the adventive and ruderal flora of Mannheim, Ludwigshafen, and the Palatinate (Pfalz). Zimmermann worked for decades and brought together huge amounts of material so that knowledge of the Mannheim adventive flora remained unsurpassed in Germany. A criticism of Zimmermann was that the localities are not sufficiently pinpointed, making it difficult to estimate what agent had caused the dispersal of the adventives—the harbor on one side or the nearby railroad and freight yards on the other side. Zimmerman thought that cereal grains unloaded in Mannheim were the most important vehicle for adventives. Most adventives were annuals that frequently did not develop seeds for lack of pollinating insects. He also found that many seeds did not germinate at all. Then he discovered that in some cases the railroad cars themselves, not the freight, were the source of the adventives, finding alien seeds in the sweepings of the roofs or cars which arrived from abroad.

Another writer, Schnyder (1910, 1914), who was the stationmaster of the Swiss railroad border station Buchs, was able to observe the vegetation in his station the year around. Schnyder discovered numerous plants which had arrived in the Buchs station as stowaways. He was convinced that the expansion of plant ranges resulted from railroad introductions, not the unaided natural dispersal of the plants themselves. The föhn wind of the Alps dispersed the seeds widely in the area. Many plants did not survive because the climate did not suit them, but many of them were reintroduced again and again. Some of the adventives found their way into the villages as grain refuse sold as feed for fowl.

During World War I Schnyder pursued interesting observations on the importance of the source of freight in introducing different adventives. Transports between Italy and Austria were of two kinds: letters and parcels for the Italian prisoners of war and citrus fruits which Italy continued to sell to Austria. Both shipments arrived in separate freight cars and were unloaded on different tracks. In the following season the citrus transports had introduced almost entirely Mediterranean weeds which were previously recognized in Zürich by Thellung as associates of citrus fruits. Around the unloading sites of the mail only cultivars were present. Schnyder also confirmed Thellung's opinion that an increased growth follows weeding because the break-up of the soil creates improved conditions for germination.

Matthies (1925) did his doctoral dissertation research on the significance of the railroad for the dispersal of plants in Mecklenburg. He frequently cited the conclusions of Lehmann (1895), but he was less interested in the synanthropes than in the vegetation of the railroads as a whole. From a botanical standpoint he examined, in great detail, the importance and influence of the so-called fixed properties of the railroad: the slopes of the dams or banks and cuts, the embankments of the tracks, and the stations or yards, considering the effects of factors such as topography, construction methods and materials, maintenance procedures, and fires in the establishment, succession, and persistence of plants. Matthies discovered that under telegraph wires, which in general accompany railroads, bird-dispersed (endozoic) plants were frequently found. Seeds fall to the ground in the droppings of numerous birds which use wires as a resting place.

Matthies accepted Lehmann's views that freight trains were by far the most important cause for introductions. However, he discovered an important side effect of high speeding passenger trains, namely, the formation of whirlwinds with suction effects that are effective in spreading diaspores.

Matthies also examined the controversial question of whether the weeding on the railroad was advantageous or harmful for an adventive flora. Lehmann (1895) had concluded that the adventive flora would be more abundant without weeding and that adventive plants receded to little used tracks. Thellung (1915) concluded the opposite. He found that luxuriant, undisturbed vegetation was composed of the most common species, while the scanty starts of reestablishing growth after weeding revealed the most interesting aliens. Matthies confirmed that in Mecklenburg the circumstances described by Thellung were also valid.

After World War I, thorough investigations of several large freight yards were made by German botanists. Until then only one large German freight yard, the München-Süd, had been botanically well investigated. The results were not separately published, but numerous findings were included in Vollmann's (1914) *Flora von Bayern.* Scheuermann (1930), during a period of six years, explored a large number of freight yards, mainly the Dortmund-Süd and Düsseldorf-Derendorf, as well as the inland harbor of Düsseldorf in the Rhenish-Westphalian industrial region. He and his collaborators collected almost 270 Mediterranean, about 60 American, and about 20 East European species. These findings showed that in this region the predominant agent in the introduction of alien plants, the Russian and Hungarian grain, played a lesser role than previously in Germany. Scheuermann pointed out that the vast preponderance of Mediterranean plants was due to the huge import of Italian citrus fruits. Sicily could be pinpointed as the main supplier. Many weeds of these warmer regions succeeded in adhering to the packing material of these fruits. Dr. Markgraf (pers. comm.) has suggested that this distinct group of introduced plants be called "citrus weeds."

Scheuermann discovered early that a surprising conformity of the alien floras existed in different German and Swiss railroad yards of the industrial region, even with regard to the frequency of appearance of single species. Three more categories, oil producing seeds and fruits, bird seeds and their associates, and citrus weeds, were added by Scheuermann to Thellung's (1919) system of introduced plants, which included: grain weeds, wool plants, ballast plants in harbors, and plants introduced by transport vehicles.

Scheuermann was primarily interested in the citrus weeds, but admitted that in some cases Mediterranean plants could be brought in by other goods and dirty cars. The citrus weeds appeared in great numbers around the unloading sites where many germinated and matured. There were species that did not miss a single year; others might fail one year, but reappear, all the more numerous, another year. As a rule, the great majority of citrus weeds showed up as few specimens and frequently as unicates. Scheuermann considered that not all alien plants were introduced by railroads but gained ground on suitable railroad soil by natural ways. He called them migrant plants. Scheuermann stated, "They are absent along the unloading sites where they have to be present if they were introduced by railroad goods." He also noted that not all introduced citrus weed seeds germinated. It was possible to collect many fruits of a *Medicago* species, however, the plant was never found.

Scheuermann had no doubt that many native German plants that had been naturalized in Italy were reintroduced into Germany with the citrus weeds along the unloading sites. He also began to recognize a serious danger to railroad plants, when the German railroads put special weed killing or spray cars in service. This greatly decreased the yield of plants. The same was beginning to happen in Switzerland. He believed that one of the most important problems to be solved was the clarification of which species were not introduced by the railroad but immigrated by themselves. This topic was discussed in more detail by Scheuermann & Krüger (1933).

Scheuermann in 1934 and 1940 returned to citrus weeds and included quite a few species which previously had defied determination. Reintroductions were observed frequently. Scheuermann also examined the effect of packing material in the manner done by Meyer (1931) and explained why many plants whose diaspores are found in packing hay were missing in the yards as living plants. Aquatic and marsh plants naturally could not be found in the yards and perennials were confronted with unfavorable local conditions, especially winter frost. Annuals were less handicapped. A closer examination of the packing hay partly explained the difference in dispersal of the citrus weeds. Plants and inflorescences that easily broke in pieces and fruits that allowed seeds to drop out appeared in yards and, to a lesser degree, on dumps. On the contrary, plants with very tough inflorescences or those in which the fruits firmly adhered to the stem were more likely to be found on dumps and seldom in yards. Scheuermann also found that an extraordinary disparity existed between the numerous introduced fruits and seeds and the number of individuals which appear as living plants. For each living specimen there were hundreds of fruits and seeds.

Bonte (1930) in his investigations for the period 1909–1927 covered the Rhenish-Westphalian industrial region. He frequently collaborated with Scheuermann, but also had other coworkers. The main difference was his approach to the problem. In contrast to Scheuermann, who confined himself to the adventive flora of the freight yards, Bonte extended the search to wherever adventives could be found. It was clear for him that railroads and ships brought in most of them on the manifold goods, fruits for direct consumption, and grain, oil fruits, and wool for processing before final use. Therefore, he directed his attention to the courtyards and adjacent lots of different manufacturing works, mills, and factories. He and his coworkers recorded 711 species.

His remarks about the influence of World War I were very interesting. In 1913, when trade and traffic were prospering with the import of foreign goods, a rich adventive flora had developed in the harbors, freight yards, and dumps. Then in 1914 the war began and every conveyance from foreign countries ceased. The number of aliens abated quickly. By 1916 almost nothing was left in places were aliens previously introduced with grain, oil fruits, wool, and other goods had thrived in abundance. After 1920 the number of alien plants began to increase yearly. In 1937 a new approach was begun by Bonte's coworker, Woermann, in Dortmund. He planted the sweepings from a Sicilian freight car which had been used in the transport of citrus fruits. He succeeded in raising in the garden a dozen different species which were potential citrus weeds. The total sum of adventives now reached 980 in the industrial region, but as mentioned before, this number included many natives which were considered to be introduced in the yards.

Meyer (1930, 1931) published papers on the freight yards of Breslau and its surroundings. Meyer was the first to record the entire vegetation of the yards, not just the adventives. Altogether 480 species were recorded, not counting obviously planted species. Weed killing, which had a disastrous effect on the vegetation of the yards, was now becoming quite common, leaving large sections of the tracks almost bare of vegetation. However, some unloading sites showed abundant vegetation around the buffers and on some green ruderal strips which were also included in his investigation.

In 1931 Meyer reported on the citrus weed question once more in great detail, after carefully observing the hay and straw used for packing, and established that the manner of handling and disposal of this material corresponded with the appearance of adventives. As many as 73 species were isolated from the hay of a single car.

Differing from the previous authors who frequently observed and collected plants in railroad yards for years, Meyer (1932, 1933a, 1933b) published his observations in speedy succession. Different questions were stressed, but a basic emphasis was always the determination of the kind of imported goods, with which the aliens had been introduced. But he admitted that not every species could be positively attributed to one of the seven groups of adventive plants of Scheuermann and considered the clarification of this question to be the most important problem of the railroad botanist. He also transplanted plants which did not manage to flower out-of-doors to a greenhouse so that they could be identified.[5]

Meyer (1937) described in detail the experiments of Johannes Spethmann who sowed residues from different imported cereals, separating them according to their provenance. The experiments showed that Moroccan barely contained seeds of a multitude of citrus weeds, but in this case introduced without doubt by barley. It clearly indicated the difficulty of assigning each adventive to a particular introduction group. Meyer also advised that it is sometimes very profitable to remove large plants from places where adventives could be expected so that they might not be suppressed from competition.

Probst (1933) published a compilation of his previous papers on the adventive flora of the Swiss canton Solothurn. Only 30 railroad plants were perfunctorily treated but adventives of three large processing factories were discussed in greater detail: 460 wool adventives, 85 cotton adventives, and 300 malt and oat adventives were found.

Hupke (1935, 1938) published reports on adventive plants in the freight yards, inland harbor installations, and dumps in Cologne, especially stressing the erratic appearance of adventives and their dependence on new introductions into the yards.

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[5] Thellung (1915) gave this same advice, but the very first who applied this method was A. H. Smith (1867) in Philadelphia.

Müller (1935) demonstrated that opportunities exist for an adventive botanist if systematic work is done at the right time and in the right place. Until 1910 only 60 adventive species were recorded from the state of Württemberg in southwest Germany. Müller was able to compile a list of 280 species from 1931 through 1934 with the help of six coworkers. Like his predecessors he tried to determine the manner of introduction. It was not always possible, but he stressed two points: the study of the habitats where the plants were found and the unselfish cooperation of botanists.[6]

Müller concluded that some adventives were introduced in several ways. Citrus weeds had to be recognized sometimes as wool adventives or even as birdseed weeds. He also supported the opinion of Scheuermann that it was necessary to distinguish migrant plants from introduced ones. Migrant plants were missing along the unloading tracks, but were spread in the yards by natural means. In four years about 250 species of hay weeds were found, 150 alone in Ulm, the principal place of his investigation. He also discovered a new introduction medium, cork, with which two Mediterranean plants were introduced into a manufacturing factory's yard.

Müller (1950) continued his research in the last years of World War II until 1948. With the start of the war the number of citrus weeds and woolen weeds began to dwindle rapidly, although not entirely. Apparently some stragglers continued to germinate after a period of dormancy. Aliens were also introduced by cattle and horse transports during the war. Altogether 38 species were counted in Ulm. According to Müller, migrant plants flourished during the war because care of the tracks and installations was limited and weed killing with chemicals did not occur. The migrant plants not only increased in numbers, but also migrated to new localities. New species had even appeared. It was astonishing that it happened in a time when the import trade had completely stopped. Several North American *Lepidium* species traveled along the trunk lines from one station to another. Very little was found after the war; since 1946 only 11 new adventives were discovered, 5 of them considered to be migrant plants.

Laus (1936) published a preliminary report on the railroad flora of Moravia, Czechoslovakia. In general, he found the railroad flora to more or less match the Moravian ruderal flora.

Fiedler (1937) studied another habitat for citrus weeds, namely the Great Central German Produce Market in Leipzig. The total terrain of the market was 16.2 hectares with 11 km of railroad tracks. Such a market assumes to a certain extent the functions of a railroad yard. From 1932 to 1936, 102 species, including a few rare natives, were found. Among them 95 were Mediterranean and could be considered citrus weeds. In Leipzig the most productive packing material was hay. Altogether 371 species, including many Leipzig natives, were isolated from the packing material of the citrus fruits during four winters. Fiedler compared all published material and found that 149 more species were found elsewhere. The total number of citrus weeds in the packing material found in Germany up to that time was 520. In 1935 Scheuermann's coworker, Woermann, was able to grow 70 species from the packing hay gathered in Leipzig. Several had never been observed before. All other foodstuffs arriving in Leipzig added practically nothing to the adventive flora of the market.

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[6] The cooperation of the adventive botanists in Germany was very close in the 1930s. As acknowledged in their papers, they exchanged results and literature, collected plants, and permitted the use of unpublished manuscripts.

Fiedler published (1944b) further developments in the adventive flora of the Produce Market for the years 1937–1942. After the outbreak of World War II, the import of southern fruits was greatly reduced; nevertheless, numerous southern plants appeared again and again around the loading sites. The sum of observed adventives was raised from 102 to 226. Before him, Jauch (1938) had published a list of all citrus weeds found in Germany and Switzerland, counting 814 species or forms. This list also included natives which he considered introduced by traffic. Fiedler was now able to increase this list to 870. He compared the number of alien plants in different cities and found that they had relatively few in common, even when the total number was not especially different. Remarkable also were the number of unicates (only one specimen during the whole observation time) and the fluctuations in the number of species recorded in a single year. The highest number of species was 128 in 1937, the lowest was 49 in 1936. The volume of imports and packing material did not change greatly so the explanation of these variations was due to weather conditions and the extent of weed killing.

Altogether 513 "hay-find" species were isolated in the course of 11 years in Leipzig from different packing materials. The total number of "hay-finds" observed in Germany was 692.

With Jauch (1938) the exploration of the citrus-weed flora in Germany came to its conclusion.[7] Besides his own observations and conclusions, Jauch gave a short survey of the historical development of the research on the citrus weed flora. He began with the astonishing statement that in the state herbarium of Baden there was not a single railroad plant from its capital of Karlsruhe. However, the Rhenish inland harbor of Karlsruhe had been systematically investigated for decades and 13 alien *Trifolium* species alone had been discovered. He repeated many conclusions which previous investigators had made. To Scheuermann's seven groups characterizing the kinds of introductions, Jauch added an eighth, segetal plants, plants introduced with seed material. He recognized that this phenomenon and its significance for agriculture was already well known to Zimmerman (1907).

The principal site of his research was the freight depot of the Karlsruhe main station which was an ideal place for the study of the citrus weeds. The station was a dead-end station situated in the inner city and no wool, cotton, cereals, or oil fruits were unloaded. Therefore, the percentage of the Mediterranean plants was especially high—93%, including some secondary introductions. It was higher than in any other German city. Altogether, in Karlsruhe 230 Mediterranean, 4 East European, 9 American, and 4 species of unclear origin were found during the five years from 1933 to 1937. He also compiled a list containing the names of all 814 citrus weeds found alive in Germany and Switzerland. Jauch was also able to determine when the railroads first began to bring citrus weeds to Germany.

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[7] However, Fiedler (1944b) and Müller (1950) later published supplements to their papers.

The first cars with southern fruits arrived in Freiburg, Baden, in 1895 and the first refuse dumping might have occurred in 1900.

Merxmüller (1952) described the altered conditions in the large München-Süd freight yard after World War II. He presumed that due to the cessation of southern fruit imports to Germany the adventive flora of the yards would have been wiped out. While citrus weeds primarily appeared around the unloading sites in the freight yards, the other introduced groups favored the places where the goods to which their seeds were attached were processed. Contrary to Merxmüller's expectation a noteworthy number of aliens were collected during several visits to the yard in 1948. Although many plants were of Mediterranean origin, they were not citrus weeds. His list was also in almost total disagreement with those previously published, and the same plants appeared increasingly on plant lists of neighboring countries. These new finds raised the question of recent migrations. Scheuermann's idea that many adventives found on railroads were not introduced by railroad traffic, but arrived there by active migration, found solid support. Of course, this strange accumulation of migrant plants was supplemented by introductions from freight and passenger trains and by sporadic true adventives.

Pedersen (1955) analyzed the origin of introduced plants found on the Danish railroads. Part of the plants were sown with impure seeds of alien origin. As is usually the case, the flora of the Danish stations was richer than that along the trunk lines. He concluded that the plants might have been introduced from surrounding localities, goods transfer, ballast, or the train itself. An important observation was made: "It may be accepted that the seed in the air circulation around a fast-moving train can be thrown up on the undercarriage where it can sit in crevices or in lubricating substances until they drop off at stations on account of vibration." Pedersen was also of the opinion that many railroad plants are "railway-wandering plants" which spread by active migration. He described this phenomenon for seven species.

Almquist (1957) gave a review of the botanical work done during the last hundred years in connection with the centennial jubilee of the Swedish railroads. He mentioned, among other things, several old reports of aliens found on embankments, but it was the same story as with the early German botanists: only the localities were stressed. The oldest reports (1859) were from the horse-drawn railroad.

Kornás et al. (1959) published their findings on the Polish railroads. In 1956 they quite thoroughly investigated the three most important freight yards in Krakow, as well as along the trunk lines for 12–16 km. Various statements made by them corresponded with those of other countries. The vegetation on the railroads was more or less xerophytic. Mesophytic vegetation was concentrated in overshadowed localities in the proximity of buildings and walls. Due to weed killing, annuals and biennials frequently only vegetated. Almost 400 species were recorded: 60.6% natives (apophytes) and 39.4% introduced (anthropophytes). Among the last, almost half were made up of archaeophytes. The percentage of the anthropophytes in the freight yards varied in accordance with the volume of the freight traffic in them.

Numerous Polish botanists published lists that frequently contained adventive novelties for the region. It was of interest to note that in quite a few cases after the publication of novelties, the same plants also began to appear in subsequent lists. Apparently after attention was called to these plants, many botanists began to go in search of them. This happened particularly with plants for which some kind of mimic was already known.

Among the hundreds of papers pertaining to railroad flora and vegetation, the one by Kreh (1960) is a treasure mine of information and is as important as the one by Matthies (1925). According to Kreh freight yards with aliens have always strongly attracted botanists. Therefore the vegetation of these yards has been well known floristically; but phytosociologists have paid little attention, and this is the approach he took. Over an observation period of 20 years in Stuttgart, he made very detailed observations on the influences of such factors as weed killers, manner of construction, construction material, soil, radiation, moisture, relief, operational techniques, manner and means of introduction, and competition on railroad vegetation. Operational techniques, freight traffic, and regularly performed weed killing using mainly chemicals were seen as the most important influences on railroad vegetation.

Hugentobler (1961) published an extensive paper on the adventive plants of the Swiss cantons St. Gallen and Appenzell, including a report by Heinrich Seitter. As was his compatriot, Schnyder, Seitter was also a railroadman. The most important conclusions of Seitter were as follows. Adventives arrived as seeds which under certain conditions stuck to car floors, in fissures of boards, on beams, on the runners of the doors, on the air slide doors of grain outlets. They fell to the ground and germinated during the normal unloading of the goods, at a collision of the cars on the switching tracks, by shaking during the movement of the train, and by blowing wind and rain. Although many seeds were shaken off, blown away, and washed by rain during train travel, areas between stations were relatively poor in plants. The adventives encountered too much competition from native plants, which were well fitted for the embankments. Thus big yields of adventives were restricted to those places where they were exempted from the competition of the natives, where the management was striving to keep the ground free of plants, such as switching tracks, unloading and dead-end tracks, military ramps, car wash installations, and places where dust and rubbish were deposited. Larger numbers of adventives might be expected where imported or transit livestock were loaded, fed, and watered. The rarest species might arrive with goods from the most distant regions, but in the era of chemical weed killing, the rare species will become increasingly rarer.

Knapp (1961) has described eight associations on the roadsides and the railroad in Hessen in West Germany. Those habitats which did not exist before industrialization have provided the potential for the development of special associations with a highly anthropogenic character. Naturalized plants played a large role in such associations in contrast to natural associations such as forests where immigration occurs seldom. The method of Braun-Blanquet (1951) was used. According to Knapp, it is quite possible that in railroad associations, as well as those along roadsides, particular ecotypes may gradually develop, then morphologically differentiated taxa, initially varieties, later subspecies and species. But the time elapsed since the creation of these habitats has been too short for the realization of those possibilities.

Kausch & Heil (1965) investigated the microclimate and the plant cover on both slopes of a railroad embankment on a section of the Darmstadt-Eberbach trunk line in Hessen which stretches almost precisely in an east-west direction. The very distinct climatological conditions on these ideal southern and northern slopes separated by only a few meters corresponded to two distinct vegetation types.

In 1968 Messenger published "A railway flora of Rutland," the smallest county in England, recording 372 species. Alien plants were scarce. Of special interest were his observations on closed and dismantled lines. The distinctive character of the railroad flora was quickly lost after railroad management practices, which maintain it, were abandoned.

Interestingly, a general survey, carried out over ten years, showed that survey areas containing railroad property averaged 50 species more than those without railroad property, showing them to be the richest from the botanical standpoint.

Suominen (1969a, 1969b) studied the plant cover of Finnish railroad embankments and railroad yards. He stressed that the use of the railroad for ecological studies has been neglected and that the interest of botanists has been mainly directed to "railway plants" which are largely rare aliens and often casuals. The studies were entirely phytosociological in character, therefore, rare plants and adventives were excluded from consideration. This paper is a gold mine of information for anyone who wants to do phytosociological work on the railroad, but for the botanist who directs his interest mainly to "railway plants," this paper is of secondary importance.

Suominen noted that the historically more collected and noted, but rare and largely casual, aliens of railroad yards are poorly represented in the total vegetation. Their role in the vegetation is clearly subordinate. Suominen objected to my statement "ein ewig Kommen und ein ewig Gehen" (a perpetual coming and a perpetual going) (Mühlenbach, 1933:99) which characterized the course of things along the railroad in Riga. Suominen wrote ". . . while true of a considerable part of the species recorded from the yards, the description does not apply to any large proportion of the vegetation." On the other hand, Meyer (1932a), who has contributed so much to our knowledge of railroad vegetation, wrote once that "the greatest value has to be placed on these adventive plants when investigating the vegetation of railroad stations." These views, of course, succinctly reflect the different aims and work of phytosociologically and floristically oriented botanists.

Concomitantly with his compatriot Suominen, Niemi (1969a) published a related paper about railroad vegetation along an approximately 51 km section of the trunk line between Esbo and Ingå station in south Finland. During excursions in 1960, 1962, and 1963, records were made of the different plants and their distribution along the line and in 1965 special attention was paid to the different habitats afforded by the railroad and the various plant communities which they harbored. His investigations have shown that various habitats could be distinguished depending upon which part of the embankment proper was scrutinized.

Gutte (1972), in the published version of his doctoral thesis, investigated the ruderal associations in western and central Saxony, as well as in some adjacent territories. He included the railroad in the scope of his work. The paper was based on 2,046 phytosociological records made on the basis of the Braun-Blanquet (1951) system. Among 38 established associations, 5 were found to occur on railroads. This was one more than Knapp (1961) had published, but the extra association was a special and limited one developing on the cinders from steam locomotives.

While a vast majority of botanists visiting the railroads, especially their freight yards, were engaged primarily in the hunt for introduced plants, a minority chose the study of associations as they develop on the railroads. There is a third group of botanists who published different classifications or systems based on ways of introduction. In each flora of a state or county or freight yard, attempts were made to distinguish between native plants and plants brought in through human activities. However, almost no one has restricted himself to an analysis of railroad adventives alone, but all have included other plants.

Watson (1847), in his *Cybele Britannica*, made the first attempt to publish a classification of plants according to their geographical origin, distinguishing five categories: 1. Native: apparently aboriginal species. 2. Denizen: at present maintaining its habitat as if a native, without the aid of man, yet liable to some suspicion of having been originally introduced. 3. Colonists: a weed of cultivated land or about houses and seldom found except in places where conditions have been favorably altered for its growth by man. 4. Alien: now more or less established, but either presumed or certainly known to have been originally introduced. 5. Incognita: reported as British, but requiring confirmation as such.

Curiously enough, "casuals" are mentioned in later literature as Watson's fourth group, but he did not use this term himself. De Candolle (1855) published his system in his botanical geography. He divided all plants into two groups, the cultivated and the spontaneously growing, the latter further subdivided as: 1. Adventives: of alien origin and badly established; may disappear. 2. Naturalized: well established in a country but positively of alien origin. 3. Probably of alien origin and 4. Perhaps of alien origin. Both 3 and 4 are well established, but the possibility of the alien origin is not certain; the doubts are stronger in the third than in the fourth category. 5. Natives: all species without any doubt as to origin; they must have existed in an epoch prior to human influence.

Ascherson (1883) used the Watson system, translating the terms into German. In 1887 Klinge used Greek to create an appropriate term. After a very brief discussion about the composition of the Baltic postglacial flora, he noted that man has been busy directly and indirectly altering the original physiognomy of the flora. By introducing a multitude of cultivated plants which frequently escape, and by spreading innumerable weeds, legitimate members of a flora appear. He termed this component a synanthropic flora. It differs from native floristic elements in that it does not have a geological history. Later this term was frequently used, sometimes in a deviating sense, possibly bringing some discredit to it. Now it has more or less disappeared in German literature, but it is still very popular with Polish and Czechoslovakian botanists. I believe that it would be worthwhile to try to revitalize the term synanthrope which refers to a plant that has arrived with the help of man. The term was first used by Klinge. The later newly created terms were no better and were not needed.

Rikli (1903) introduced the term anthropochores, denoting with it those plants which settle without any assistance of man only in artificial habitats. Consequently, anthropochores include the entire ruderal and adventive flora. He distinguished several subgroups. One of these included the European segetal field weeds. Field weeds must have accompanied different cultivars which were introduced step by step by man in prehistoric times when the nomadic tribes began to settle and turn to agriculture. There is no doubt that the majority of weeds of neolithic grain fields came with the seed grain from the Near East, which is thought to be the home of the oldest cultivars in Europe. Doubt still exists for only a few weeds whether or not they were indigenous elements. As these weeds appeared in Europe thousands of years ago, European botanists have not considered them to be aliens. Rikli created the term archaeophytes for this very distinct group. They also came to America in the same way, but American botanists consider them as aliens and characterize them as introduced or naturalized from Europe. They have grown on American soil only a few hundred years and therefore their status is clearly different than in Europe. Another subgroup, the apophytes, should be mentioned. Apophytes are plants native in a region and normally growing in natural habitats, but showing a tendency to spread to artificial ones.

A very detailed classification system of the ruderal and adventive flora of the Swiss canton Zürich has been published by Naegeli & Thellung (1905). Although a joint publication, Thellung developed the classification so the system is widely known under his name. Thellung perfected his system in subsequent papers (1907, 1911–1912, 1915, 1918–1919, 1919) introducing some insignificant changes. A description of this system will be given after a short review of other authors who have created terminology for alien plants.

Simmons (1910) chose the general term hemerophytes based on the kind of habitats where alien plants alighted. Alien plants found on railroads could be attributed partly to his kenapophytes and partly to his chomapophytes. According to Linkola (1916) the term hemerophiles is preferable. Sterner (1938) returned to Klinge's term, synanthropes, but in his definition they are species whose immigration seems to involve human activity. To them belong not only escapes from culture and those species which were introduced unintentionally by man, but also those whose spontaneous immigration is made possible by the creation of suitable habitats through human activity. Walter (1954) used the term adventives, including under this cultivars. Jalas (1955) criticized the seemingly endless proliferation of technical terms for essentially the same phenomena, but developed his own classification on a character or feature of the habitats; chiefly how they were changed by man. Alien railroad plants found their place among his euhemerobes. He restricted the term anthropochory to cases when man personally performed the transfer. For all other events he proposed the term hemerochory where the indirect activities of man in one or another form is the agent for transfer.

A system elaborated by Kreh (1957) presents difficulties in finding equivalent English or classical language terms for the German terms that he employed. They frequently differ in such slight nuances, that they could almost be considered as synonyms. Kreh complained that confusion has frequently prevailed in adventive botany by use of previously proposed terms for different concepts. His own system was later subjected to criticism and "improved" (Schroeder, 1968–1969). Kreh divided the plants of a flora into natives and foreigners. Foreigners were indoor and greenhouse plants, as well as "inconstant guests" (without any more explanation). Natives comprised wild plants and cultivated plants. Cultivated plants were subdivided into useful and ornamental plants. Wild plants were subdivided into original and adventive plants. Kreh emphasized that it was necessary to approach the problem of nomenclature of adventive plants from three different points of view. One must take into consideration the time of immigration, the degree of naturalization achieved, and the manner of immigration. For each approach he created special or unrelated terms. He also recognized a group of alien plants called "fraudulent or smuggled"[8] plants, overlooked by almost all previous writers. These plants have been sown or planted deliberately in natural habitats by such persons as bee keepers, collectors of medical herbs, lovers of aquaria, and idealistic botanophiles.[9] Of course, only a few would naturalize.

For the basis of his classification Kamyšev (1959) took into consideration the degree of adaptability, as well as the presumed genesis connected with the development of agriculture. There were difficulties including alien railroad plants in his scheme. They could be placed under his komophytes and partly under agriophytes, which should not be confused with his agrophytes.

The question of terminology came into discussion during the preparation for the *Flora Europaea*. Hylander (1961) recommended the use of "natives" and "aliens" in Scandinavian floras; the last being composed of "naturalized" and "casuals." Native and naturalized plants then comprise the "constant member of the wild flora."

The system of Holub & Jirásek (1967) is very extensive, employing 29 different terms including those used previously by others and those contributed by themselves. In elaborating their classification, they paid attention to the influence of human activity, but also to the origin of the plants in the region, their adaptiveness to secondary habitats, their penetration into natural plant associations, and their degree of naturalization. For a railroad flora this detailed system is of little use because it demands knowledge of whether different plants observed on the railroad are able to establish themselves in natural habitats which are more or less free of human influence and how they behave there. On the railroad (at least in St. Louis) natural habitats are almost nonexistent.

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[8] Kreh introduced the German expression *Angesalbte*. This word and the corresponding substantive *Ansalbung* found approval and appears now and then in German papers. The verb *ansalben* from which the words are derived has different meanings. In this case it apparently should mean "to cheat." Those plants are cheating the observer by leading him to believe that they are natives. I think that the word "fraudulent" would be an appropriate translation, but also "deceitful" or "deceptive" would not be incorrect expressions. Perhaps the second term "smuggled" plants (*eingeschmuggelt* in the original) might be best, at least in English. This term, created by Gradmann (1950), has been used by Kreh as a synonym. Müller-Schneider & Lhotská (1971) called deliberately introduced species ethelochores. Brenan and Eckardt (pers. comm.) suggest calling them imposturous plants.

[9] Brockmüller (1880) retold the story in his paper on plant migrations that Goethe constantly had with him the seeds of the sweet violet (*Viola odorata* L.) and that he disseminated them on his strolls around Weimar. Involuntarily one has to think about Johnny Appleseed who had the habit of scattering seeds in Ohio. Brockmüller thought that such premeditated falsification of nature is reprehensible. The practice has been prohibited since 1937 in Germany (Weber, 1961).

Schroeder (1969) analyzed existing systems of terminology and found them mostly unsatisfactory. He pointed out that there have been attempts to combine three different principles on the basis of which plants could be classified: the time of their immigration, the manner of their immigration, and the degree of naturalization. He observed that the effort to create a universal system which takes into account all possibilities may in the end produce an unserviceable collection of words. For this reason, he proposed three independent systems. First, he considered the degree of naturalization and distinguished five categories: idiochorophytes (identical with the concept of natives), plants with a constant position in the primary natural vegetation; agriophytes, plants with a constant position in the potential natural vegetation, but not in the primary one; epecophytes, plants with a constant position in the actual but not in the potential natural vegetation; ephemerophytes, plants with no constant position in the vegetation, but occasionally growing wild; ergasiophytes, plants growing only in cultivation. Secondly, he considered the time of immigration and distinguished three categories: idiochorophytes, plants having immigrated before the activity of man; archaeophytes, plants whose man-supported immigration happened in "prehistoric" times; and neophytes, plants whose immigration took place in historic time. The third classification was based on the manner in which man supported plant immigration and consists of four categories: idiochorophytes, plants which immigrated without any aid of man; acolutophytes, plants whose immigration was supported only by the anthropogenic changes of vegetation which offered suitable habitats to the species migrating otherwise by their own abilities; xenophytes, plants whose diaspores have been introduced accidentally by man; and ergasiophygophytes, plants which have been introduced intentionally as cultivated plants and then escaped.

Most of the cited writers on terminology usually pointed out the weaknesses in the classifications of their predecessors. Trying to do away with them, they elaborated new schemes which often became more complicated. The system of Schroeder is the most applicable, although one has to keep in mind that there are three independent classifications.

Walter & Straka (1970) returned unconditionally to the original system of Thellung in their text book on phytology. Thellung's classification has, in fact, been used continually during these controversies by many field-workers, such as Kornás et al. (1959) and Jehlík & Slavík (1968), for example. Thellung (Naegeli & Thellung, 1905) used the terms apophytes and anthropochores. Together they constitute his anthropophytes which he placed on a par with Klinge's synanthropes.

Thellung divides anthropochores into seven categories and the apophytes into two categories as follows:

I. Anthropochores. Plants brought in by man.

   A. By intentional activity of man: foreign cultivars and their derivatives.

      1. Ergasiophytes. They include practically all cultivated plants such as grains, fruits, vegetables, forage, fiber, oil, and medicinal plants, and numerous ornamentals. They do not originate locally, and they all more or less need the care and protection of man to thrive.

      2. Ergasiolipophytes. These are usually descendants of cultivars that are able to maintain themselves after the cultivation by man has ceased. They are frequently perennial and woody ornamentals. They are frequently found around the ruins of medieval castles in Europe, supposedly having persisted there since the Middle Ages. Similarly, in the flora of Missouri, many species persist in abandoned farmyards, old cemeteries, etc.

      3. Ergasiophygophytes. This category is much larger than the preceding one. It consists of ergasiophytes or cultivars which have escaped without the knowledge of man from the place of cultivation and have settled on artificial or natural habitats. Mostly they disappear quite rapidly. In new localities they miss the support of man, and without his aid they mostly are not equal in competition with native plants and perish. In some cases they are able to adjust to prevalent conditions, especially climatic ones, and are capable of surviving competition and may even begin to spread. In rare cases they may grow rampantly and drive out the native flora. The most infamous example in the United States is *Lonicera japonica* Thunb. of which *Gray's Manual of Botany* said: "a most pernicious and dangerous weed, overwhelming and strangling the native flora and most difficult to eradicate." In the case of ornamentals, ergasiophygophytes are frequently called garden escapes.

   B. By involuntary intervention of man: foreign weeds.

      4. Archaeophytes. These are field weeds inadvertently introduced in prehistoric times with crops.

      5. Neophytes. They occur relatively frequently and permanently in natural habitats and are often associated with the native vegetation. They do not depend on the continued activity of man to survive.

      6. Epecophytes. These are plants that appeared in modern times, are more or less numerous, but are restricted to artificial habitats. They are dependent upon man for their existence in that he maintains those habitats or is compelled to create them again.

      7. Ephemerophytes. These are plants that appear only sporadically as transients, almost exclusively on artificial habitats. A large part of a railroad flora belongs here.

II. Apophytes. Plants originally wild on natural habitats, but later growing in artificial ones.

  A. By intentional activity of man.

    8. Ekiophytes. They are native cultivated plants, grown as ornamental or useful plants.

  B. Spontaneously establishing in artificial habitats.

    9. Spontaneous apophytes.

Thellung's scheme just outlined is abbreviated because a few subgroups having no relation to a railroad flora are omitted. Thellung returned several times to the problem of terminology. Some slight changes were made and he combined archaeophytes and epecophytes in 1915 because they were equivalent. He also emphasized the importance of establishing anthropochores' immigration and introduction. The most elaborate scheme is given in his last paper (1919):

A. Weeds of foreign cultivars (useful and ornamental plants) introduced with seed material or as cuttings.

B. Species introduced by way of commerce and traffic.
  1. With foreign grain and oil seeds; weed floras of mills, granaries or grain elevators, malt factories or mills, breweries, oil mills, mustard factories, and so on.
  2. With cotton or wool; floras of wool washing establishments, cotton mills, cloth factories, and so on.
  3. With the ballast of ships; older adventive floras of many harbors.
  4. By traffic conveyances in general, trans-Atlantic ships, inland navigation on rivers and canals, truck and railroad traffic, passage of nomadic tribes (gypsies), transports of cattle, movements of armed forces and materials in wars.

There is no doubt that it is extremely difficult for a railroad botanist to keep apart the causes of weed introductions as characterized by subgroups A and B. Only in exceptional cases is it possible to discover the origin and the purpose of an import which occurred a year before. The situation is quite different when one examines weeds in a field or an orchard planted with imported seed material. The number of publications dealing with introductions under such circumstances is great. Frequently astonishing yields of adventive weeds are revealed. In such research Thellung's subgroup A is completely justified.

Stratiobotany is a term coined by Thellung (1917) to deal with the effects of war on vegetation. He wrote the paper while the war still raged, but the first authentic reports had become known. Even much earlier, the famous case of the siege of Paris (the florula obsidionalis) in the 1870–1871 war may be cited. An abundant exotic vegetation of Mediterranean species developed in the vicinity of Paris during the Franco-Prussian war (Gaudefroy & Movillefarine, 1871). Others who have published on this are Bonte (1930), Davidsson (1967), Koegeler (1949), Kupffer (1922), Pfeiffer (1956–1957), Salisbury (1943), Schreier (1955), and especially the Finnish botanists Erkamo (1944–1946), Heikkinen (1959), Luther (1948–1949), Mannerkorpi (1944–1945), and Niemi (1969b). It was especially in World War II that the railroads, and especially the freight yards, were affected as they were always important military targets. The term polemochores, meaning followers of war, was coined by Mannerkorpi (1944–1945) to denote those alien plants introduced primarily as a result of war-related activities. A special group of polemochores are hippochores—plants introduced during a war by use of horses and their forage. In the spread of polemochores and hippochores railroads played by far the decisive role.

Naturally the question arises whether some of the synanthropes collected by me in St. Louis are polemochores from World War II. No definite proof exists, but it is highly probable that at least some polemochores arrived in St. Louis with military transports. The idea is supported by Fell's (1962) discovery of a very curious accumulation of western plants in a small area within Camp Grant in Winnebago County, Illinois. Fell considered two possibilities. They could be relics of dying populations; or, on the other hand, this particular tract was an important station and trench warfare training center during the war. Numerous horses and mules were shipped here from west of the Mississippi River, as were hay and straw in bales for use as bedding and in making ramparts for trenches and effigies for bayonet practice. Taking the European knowledge of hippochores into consideration, there is no doubt that only Fell's second explanation is valid. Finally, it must be said that this review of literature about railroad botany is by no means complete. An almost boundless literature exists in Europe on this subject. Nevertheless, I believe that the cited papers and books include some of the most important literature and give a definite understanding of this branch of botany.

History of Railroad Plants in Missouri

From the scanty literature it is apparent that interest in railroad plants has not been especially high in St. Louis. It is true that Eggert (1891) predicted that "railroads will bring new immigrants from other regions . . . ," but he did not mention a single case, although his list did contain some plants whose introduction by railroads is conceivable. Duggar (1922, as anonymous) wrote about plant immigrants in the St. Louis local flora. He stressed several modes of distribution, one of them being the railroads. He separated native North American plants (33 species) and "exotic" plants (19 species—mostly originating in Europe), and tried to draw a line between transient (13) and permanently established (6) immigrants. Of these 19 species 15 were also found by me, but, at least in Duggar's time, 9 were found only outside St. Louis. His region included most of St. Louis county and even a strip of Illinois, thus following the boundaries of the local St. Louis flora as established by the Engelmann Botanical Club (1911). There are also frequent references to railroad plants in Steyermark's (1963) *Flora of Missouri.*

In the western part of Missouri, the railroad flora has drawn much more attention. Jackson County, which includes Kansas City, Missouri, is botanically well examined and much regard was paid to the railroads, although the very

TABLE 1. Railroad companies (and acronyms) of St. Louis whose right-of-ways were studied for synanthropes.

1. Burlington-Northern (formerly Chicago, Burlington and Quincy RR) (BN).
2. Chicago & Eastern Illinois RR (C&EI).
3. Chicago, Rock Island, St. Paul and Pacific Lines (Rock Island RR) (RI).
4. Illinois Terminal RR (ITC).
5. Manufacturers Railway (MRS).
6. Missouri-Kansas-Texas RR (MKT).
7. Missouri Pacific RR (MP).
8. Norfolk & Western Railway (formerly Wabash RR) (N&W).
9. St. Louis-San Francisco (Frisco) Railway (SL-SF).
10. Terminal Railroad Association of St. Louis (TRRA).

first beginning was not especially encouraging. Bush (1882), whom Steyermark (1963) calls one of the most active collectors in Missouri, had started exploration with the hope that the flora would be greatly enlarged by seeds sown along the railroad lines. But already in his first report Bush (1882) admitted that "in this, however, we are disappointed, for very few plants have been introduced by the means above mentioned." But things soon began to change. Several supplements followed. In 1902 Mackenzie, assisted by Bush, published a *Manual of the Flora of Jackson County.* This time they found that "the expectation [to find many foreign plants in such an important railroad center as Kansas City] is amply borne out." Into the 1950s the Jackson County botanical studies were unsurpassed in Missouri.

STUDY AREA

Although many botanists have included the history of the botanically investigated railroad centers in their studies, this will not be attempted in this paper. The history of railroads in the United States is bewildering, and the railroad companies which touched St. Louis at one or another time far exceed 100 (Hyde & Conrad, 1899; Economic Educational Council of Greater St. Louis, n.d., 1959). In the present study the right-of-ways and freight yards of the ten remaining railroad companies in St. Louis were actually studied for their adventive flora. These companies and their abbreviations are listed in Table 1 and located in Fig. 1. Besides these ten, the St. Louis Water Works Railway which connected the city's water works was studied up to 1960. Only a few plants of interest were found here. The line is now dismantled. The numerous industrial sidings or spurs which are not directly owned by the railroad companies were, for the purposes of this study, ascribed to the railroad with which the spurs are connected.

As previously mentioned, the St. Louis metropolitan area has a railroad network that is the second largest in the U.S. Therefore strict restraints became inevitable. The railroads in East St. Louis and some other adjacent municipalities of Illinois were excluded, although the bulk of the railroads of the metropolitan area is located east of the Mississippi River. St. Louis County was also excluded and only the area of the City of St. Louis was used in this project. But even so

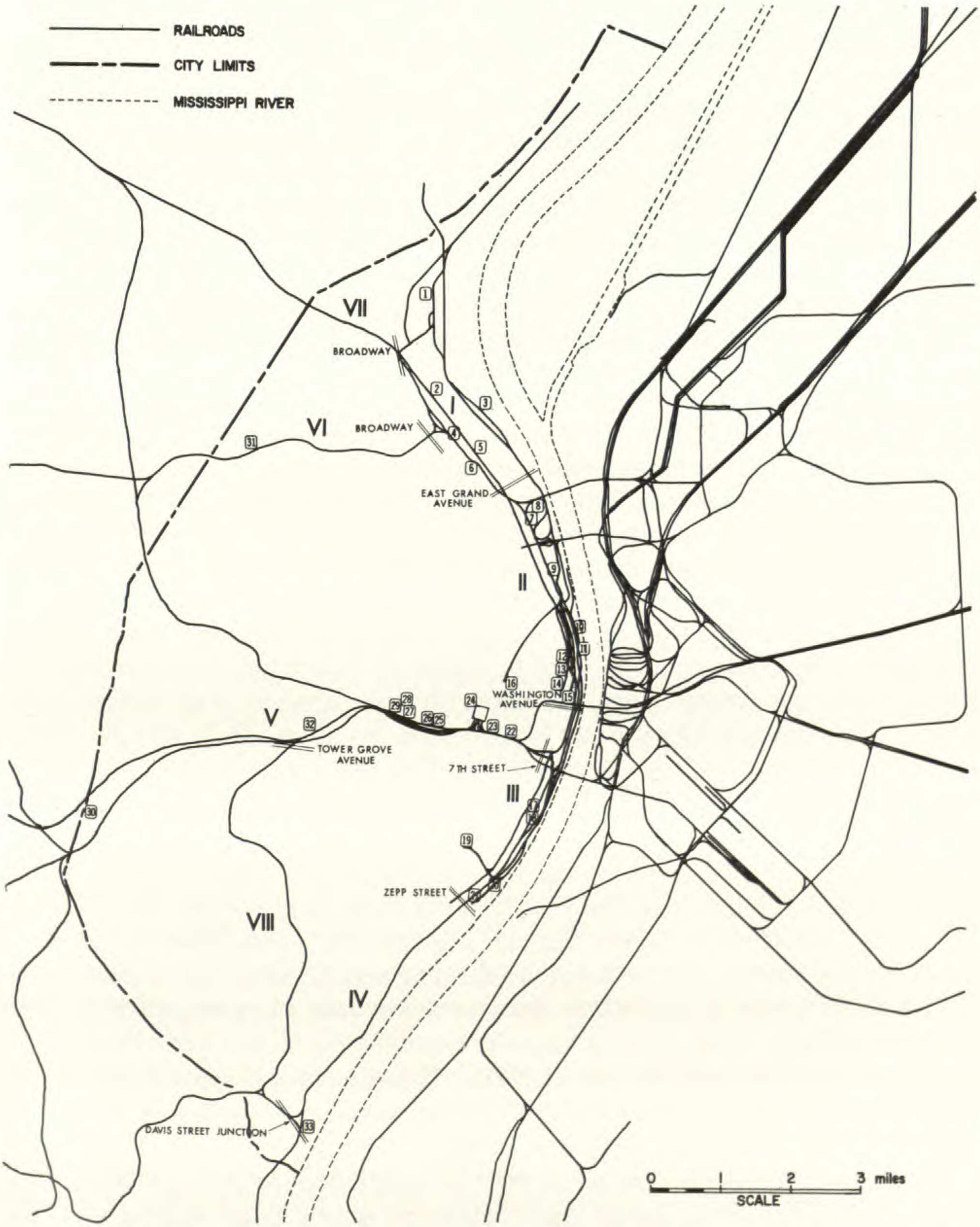
RAILROADS
CITY LIMITS
MISSISSIPPI RIVER
VII
BROADWAY
1
2
3
I
VI
31
BROADWAY
4
5
6
EAST GRAND AVENUE
8
7
9
II
10
11
12
13
14
16
WASHINGTON AVENUE
15
24
28
29
27
26
25
23
22
V
32
TOWER GROVE AVENUE
7TH STREET
III
17
18
19
ZEPP STREET
20
21
30
VIII
IV
DAVIS STREET JUNCTION
33
0
1
2
3 miles
SCALE

FIGURE 1. Railroad network in the city of St. Louis. See Table 2 for the names of the freight yards indicated by numbers in the figure. The double lines separate the regions.

the chosen area proved to be vast. It was not possible to get accurate information about the total length of all tracks in St. Louis, but it certainly extends many hundreds of miles. In order to increase the efficiency of collecting and to obtain a better idea of the distribution of the plants, the whole railroad network in the limits of the city of St. Louis was divided in eight regions (Fig. 1). The first four regions are along the Mississippi River, along which most of the railroads settled, and the remaining four include the westward-pointed trunk or main lines.

Region 1. It stretches from the northern limit of the city to East Grand Ave. Freight yards 1–6 (Table 2) are located in it. The grain elevator of the St. Louis Grain Corporation is connected with the North St. Louis Freight Yard.

Region 2. It extends from East Grand Ave. to Washington Ave. and includes freight yards 7–16 (Table 2). Two grain elevators are located in the Tyler St. Yard (10). Here also runs the "High Line" tracks of ITC which for the most part are elevated, while the dead end is underground in downtown St. Louis.

Region 3. It stretches from Washington Ave. to Zepp St. The freight yards are 17–21 (Table 2). An elevator was located in the Lesperance St. Yard (17) but it burned down several years ago. Some tracks in this region are owned by the city of St. Louis, but are now leased and operated by the TRRA. Quite a few plants found on these city tracks are counted as TRRA plants.

Region 4. It extends from Zepp St. to the Davis St. Junction, which separates it from Region 8. It includes freight yard 33 (Table 2). Almost all tracks, as well as a big grain elevator, are owned by MP. A few short sidings of MRS laid on some streets and protruding south of Zepp St. are included in Region 4.

Region 5. It begins west of 7th St. but excludes the elevated tracks east of this street. The tracks run westward to Spring Ave., through the so-called Mill Creek Valley, for several miles, a section with the heaviest train traffic in St. Louis. Approximately 19 yards are located here, including 22–30 and 32 (Table 2) which were investigated. Numerous industrial spurs branch off in this region, and the grain elevator of the St. Louis Grain Corporation (Sarah Ave.) is located along the N&W line.

Region 6. The tracks (TRRA) branch off from the Harlem Freight Yard and Broadway is a boundary. Numerous industrial spurs branch from the main line and serve a multitude of industrial plants. Among them, the Pillsbury Company flour mills at Shreve Ave. are botanically important. The Pickrel Yard (31) (Table 2) is located in this region and an extensive net of spurs penetrates into the surroundings.

Region 7. This is the domain of N&W. It begins at the western end of the Luther Freight Yard at Broadway and is traversed by the trunk line to Omaha. In the city limits only two spurs branch off.

Region 8. This is the domain of MP. It begins west of the now dismantled Tower Grove Passenger Station (32) (Table 2) after a level crossing with the tracks of SF-SL (Tower Grove Avenue). The general course is at first to the west, but afterwards it turns south. From this trunk line to Little Rock, Ark., many spurs branch off, the longest being Christy Lead. Some railroads have a trackage right to use certain tracks of another company.

During the years of this study almost all tracks in the city were visited. The exceptions were the two tunnels and the existing elevated tracks of TRRA, ITC and MP, where vegetation could hardly be expected. Also no attempts were made to botanize the ascending grades to the four railroads carrying bridges.

TABLE 2. Freight yards in St. Louis studied for synanthropes.

1. Baden (MKT)
2. Luther (N&W)
3. North St. Louis (BN)
4. Harlem (TRRA)
5. Carrie Ave. (RI)
6. Bulver (TRRA)
7. Bremen (TRRA)
8. K Line (TRRA)
9. St. Louis Ave. (N&W)
10. Tyler St. (TRRA)
11. O'Fallon (TRRA)
12. Inbound Freight Yard (RI, SL-SF, C&EI)
13. Biddle Freight House (MP)
14. Wabash Fruit Terminal (N&W)
15. Carr St. (BN)
16. Freight Depot (ITC)
17. Lesperance St. (MP)
18. Lesperance St. (TRRA)
19. Miller St. (MRS)
20. River (MRS)
21. Cherokee (MRS)
22. 7th St. (SL-SF)
23. 18th St. (TRRA)
24. Union Station (TRRA)
25. East Jefferson (TRRA)
26. West Jefferson (TRRA)
27. South Ranken (TRRA)
28. Compton (TRRA)
29. North Ranken (TRRA)
30. Lindenwood (SL-SF)
31. Pickrel (TRRA)
32. Tower Grove Passenger Stations (closed) (MP, SL-SF)
33. Broadway Passenger Station (closed) (MP)

BACKGROUND TO THE STUDY

Altogether 563 excursions were carried out in 18 years (1954–1971), the minimum being 21 (in 1959) and the maximum 55 (1970) per year. The first years were spent becoming acquainted with the entire railroad network. Synanthropes can grow anywhere on the railroad, but are frequently found in great abundance in small areas. These rich places must be searched for since they are only distinguished by their richness in synanthropes. As a general rule, however, freight yards are richer in synanthropes than trunk or main lines. This is shown in that of the 208 St. Louis railroad species rated as very rare, 116 were found only in freight yards, 50 only along the trunk lines, and 42 in both places. Therefore more attention was normally paid to freight yards in the later years of this study, without neglecting trunk lines. A few of the most profitable places for finding synanthropes may be mentioned. Switching or classification tracks in the yards were rich in synanthropes during the early years. The bumping of cars during the classification operations often cause seeds, which become lodged on the cars in transit or in loading areas, to fall off, and clouds of dust can also be frequently seen. We have known since the time of Zimmermann (1907) that such dust may contain diaspores. Holding or storage yards and the buffers at the end of sidings were also good collecting places, but the richest areas were the so-called cleanout tracks, Carrie Ave. Yard (5) (RI), North St. Louis (3) (BN), Baden (1) (MRT) (see Table 2), where cars were cleaned before reloading. Refuse heaps accumulate along such tracks and many synanthropes may be found near them. In the St. Louis Ave. Freight Yard (9) (N&W) a certain track was also very rich in synanthropes. The reason for it was not easily discernible. Although I earlier expressed the idea that introductions might in this instance have been made from trucks from an adjoining parking lot (Mühlenbach, 1960), I have not been able to confirm this.

The introduction of the piggy-back method for freight movement during the last 15 years initially seemed to result in a larger number of introductions, but also in an almost concomitant increase in the use of weed killers that quickly and effectively limited new introductions.

The surroundings of St. Louis grain elevators, in contrast to Europe, have not developed rich adventive floras. One reason is that in Europe imported grain from far away is often stored, while in St. Louis the elevators receive the grain primarily from Missouri and nearby states. But more important than the distance factor is the treatment of shipped grain. In St. Louis grain has already been cleaned, and this may well explain the poverty in synanthropes in the vicinity of grain elevators. The German elevators, for example, at least in earlier years, had to clean the Russian and Hungarian grain. The separated refuse was a rich source for synanthropes.

Likewise the visits to the St. Louis Produce Market, located on the St. Louis Ave. Freight Yard (N&W) and through which a huge amount of fruits and vegetables passes, were disappointing. Since most of the area is paved, one may only find potatoes, tomatoes, dill, lima beans, coriander, and some members of the gourd family growing in remote places, but practically no rare weeds and nothing similar to the rich citrus-weed flora found in Germany around similar establishments.

Hay or straw has never been observed to have been used as packing material. Poor results were achieved by visiting the St. Louis Terminals Corporation's harbor (North Market St.) or the courtyards and the receiving platforms, pens and cattle yards of Mayrose Packing Company's slaughterhouse (Vandeventer Ave.). Much better was the vicinity of Pillsbury Company flour mills, Shreve Ave. along the TRRA tracks, as well as in the courtyard of the mills. The surroundings of the Wabash Fruit Terminal (200 Carr St.) where fruit and vegetable shipments arrived were also good. Late in 1962 the use of this terminal for such purposes was discontinued and the synanthropic flora grew poor afterwards.

Yard margins frequently have a luxurious growth of plants in comparison with the tracks. This is in part due to the fact that weed-killing procedures are often not extended to the margins. However, the composition of the vegetation is much poorer along the margins but some species prefer these margins, as for example some composites and *Saponaria officinalis*, which is a rarity on the tracks but locally frequent just on the margins.

In some yards large unused lots were luxuriously overgrown with a tall vegetation that was for the most part much richer in species than that found on the margins. Synanthropes were not rare, but they were often ergasiophygophytes due to illegal dumping.

Synanthropes along trunk lines seemed to be most abundant along the MP line to the west (along Manchester Ave.) in Region 5 and along the N&W trunk line (along Gladys Ave.) in Region 7. A new kind of plant introduction, not mentioned in the cited literature, was discovered here. The percentage of ergasiophygophytes was unusually high. Heaps of hay were scattered about. It seemed that the owners of the nearby houses dumped their lawn cuttings on the railroad right-of-way. Plants obviously intentionally planted along the railroads were, of course, not included in the list, but those growing on railroad property as a result of dumping of garden refuse were included. The industrial spurs or sidings contributed very little in general.

Only very slowly did I begin to realize that an important difference exists between the American and European railroad systems. One of the crucial differences is that in America most freight is delivered directly to industries without having to pass through a central freight house as in Europe. The majority of the St. Louis freight yards are simply classification yards that direct freight to industrial receiving points. Therefore, the opportunity for hitchhiking diaspores to escape on the railroads is much less than in Europe, where the bulk of goods is handled in the freight yards.

One of the factors that influences the dispersion of synanthropes currently is the trend to replace the uppermost layer of the ballast on which the tracks are laid, and for which grit or even sand has been traditionally used, with coarse crushed stones or gravel. This was done during the remodelling of the Luther Yard. It is clear that the old kind of surface allows germination and growth of plants much more readily than the modern gravel or crushed stones. Such remodeled tracks are often desolate throughout. If similar modernization of other freight yards should also be undertaken, it will be a formidable blow to the synanthropic flora of the yards, which is already for the most part under the scourge of weed-killing procedures.

I made every effort to pinpoint the exact localities of at least the rarer synanthropes. This was important so that their persistence following introduction could be determined. It was also important from another point of view. Many plants when discovered were frequently too young for certain determination. In the case of unicates these were left to mature and then collected later. In case of duplicated plants, some were taken and the rest were left to mature. Early on in this study it became clear that this was the best procedure since immature unicates could rarely be identified precisely, even by experts. In the case of larger unicate specimens, branches were collected at various stages of growth until adequate material for determination was obtained.

There are very frequent changes on the railroads. Tracks can be relocated, buildings demolished, whole yards abandoned and dismantled, businesses shut down or changed in ownership. During this long-term study, it was impossible to update the labels of the herbarium specimens to reflect these changes and all names on the labels reflect the names and conditions existing at the time of collection.

As previously mentioned, the prehistoric segetal weeds—archaeophytes—are considered to be introductions in America, in opposition to the prevailing European concept. Quite naturally these are included in the general list and treated like the later arrivals. Many of the archaeophytes have been naturalized in America, as happened earlier in Europe. It is clear that most of them grew here long before the railroad era began. Frankton & Mulligan (1974) reported that *Linaria vulgaris* was a serious weed in North America already in 1758, while *Capsella bursa-pastoris* was known before 1700. Surely quite a few of them came to the New World with the grain brought by the first immigrants. However, indications of their early presence in Missouri can generally not be confirmed from herbarium records since the early collectors neglected weedy plants. For instance, of the 28 most common weeds of this study, only one sheet of *Sonchus oleraceus* (by Engelmann in 1839) was collected before 1851 (when the first railroad opened for traffic) based on the collections at the Missouri Botanical Garden.

Deliberately cultivated plants (ergasiophytes) were not taken into account in this study, but cultivated plants that naturally escape from cultivation (ergasiophygophytes) were recorded. A list of all the species (63) known to be cultivated as a useful plant in some part of the world was evaluated by Dr. A. E. Gaus (Cooperative Extension Service, Univ. of Missouri) as to their status of cultivation in Missouri. Some (such as *Abutilon theophrasti*, *Matricaria chamomilla*, and *Cichorium intybus*) have never been cultivated in Missouri (Gaus, pers. comm.). Many plants are cultivated only rarely. For example, *Secale cereale* is cultivated only "very little" and *Linum usitatissimum* was cultivated "30 years ago." Rye is now frequently encountered on the railroad, and flax is no rarity at all. Their seeds apparently come from far away. Of course, in most cases the origin of the ergasiophygophytes is quite clear—they are either escapes from gardens adjoining the railroad or their diaspores have been illegally dumped on the railroad premises. But sometimes such plants have been found in freight yards far away from gardens, amidst many weedy synanthropes that have come from far away. The possibility then cannot be denied that these ergasiophygophytes have been introduced without the direct help of man, and their status is the same as for noncultivated species introduced without direct help. In any case, ergasiophygophytes are included in my list, as so many European adventive botanists have done before me.

METHODS

It was clear from the beginning of this study that all plants encountered had to be collected since there was in most cases no way to decide whether they were native or synanthropic. The quantity of each collection depended upon the availability of the specimens and their sizes. Small plants were collected in large numbers, if they were numerous. With medium-sized plants 5–10 specimens were taken when there was no danger of exterminating the species. With very tall and weedy plants only parts were taken. Juvenile plants frequently presented difficulties. In such cases one or a few specimens were taken. Unicates mature enough for determination presented a problem. To remove them meant their demise. However, it was clear from the literature, as well as from my own experiences, that the majority of newly introduced synanthropes perish even if they are left undisturbed, and even if they have developed ripe fruits. Unicates were therefore "sacrificed" for the sake of the herbarium. Only juvenile unicates were left in the hope of collecting them later when more mature. From tall unicates, juvenile or mature, only parts were taken. It was not feasible to transplant juveniles (see Fiedler, 1944a). No attempt was ever made to propagate plants artificially on the railroad, even when plenty of ripe seeds and fruits were available.

In 1954 each species encountered was collected for a total of 518 numbers, including, of course, some multiples. Beginning with 1955, a systematic compilation of all synanthropes was started with an estimation of their frequency. A list of known introductions in Missouri was compiled from Palmer & Steyermark's (1935) *Annotated Catalogue of the Flowering Plants in Missouri* and from Steyermark's (1963) *Flora of Missouri*, as well as from some other sources. In another list species were entered whose introduction could be anticipated. Many of these species were subsequently discovered, although a good number have not yet been found. They may not have been introduced, or they may have been missed for one reason or another. A more precise knowledge of distribution of the synanthropes was sought during the second half of this study. The general list of all hitherto discovered synanthropes and their distributions in each region was prepared and was amended when more synanthropes became known or when some previously included plant was disqualified. Of course, the recorded locations also increased vastly. These lists also showed considerable gaps in the distribution, many quite common plants missing in one or another region, and for the most common of these a deficiency index was prepared for each region. The corresponding indices were carefully scrutinized before each excursion. This helped immensely to fill in many of the gaps. Quite a few synanthropes were recorded in seven regions and there were no apparent reasons why they should not have grown in the eighth region, too. *Pastinaca sativa*, for example, is a frequently encountered plant, tall, conspicuous and gregarious, but it was never discovered in the quite large Region 4.

The occurrence of a plant can be examined from two points of view: how the plants are distributed over the entire railroad territory; and how they appear locally in the yards and on the right-of-ways. Eighty species were recorded in all eight regions. Their distribution is called "widespread." Twenty-eight plants were found in seven regions and are described as "quite widespread" plants. A widespread distribution does not indicate by any means that such a plant is numerous. Several are rarities (e.g., *Digitaria ischaemum*) and are seldom seen in many regions, sometimes even as unicates, although many of the widespread plants do indeed compose the dominant part of the railroad vegetation.

There have been many proposals to describe frequency of plants in a given area. The mathematical system advocated by Henker (1960), although precise, was not applicable in this study because of the very strong fluctuations in a railroad flora that is not growing in a natural habitat and because of the constant reintroductions of species. Other systems have been proposed by Braun-Blanquet (1951) and Nelson (1963), among others. However, for the purpose of this study it seemed best to use five categories of frequency: common, frequent, scattered, rare, and very rare. Each taxon was considered to be very rare if it was observed in not more than five localities during the 18 years of this study. Repeated observations of the same plant in the same place through the years were not counted. Plants were considered to be rare if they were observed in between 6 and 40 localities. The evaluation of the remaining categories was entirely subjective and was subject to change throughout this study because of the very large fluctuations of many plants. In order to maintain the accuracy of this system I avoided excursions beyond the railroad in all the years of this study so that the categorizations of frequency is based entirely on the actual conditions along the railroad.

SYSTEMATIC SECTION

Table 3 lists the distribution of the synanthropes in the eight regions. Infraspecific taxa as far as available, are included. I decided not to list plants whose determination was not certain, although I was urged by several persons to do so. This could, I was told, encourage a search for them in the future, but I very much doubt that there will be followers of this kind of work in St. Louis. Also, my experiences in Riga have shown that little can be achieved by publishing uncertain plants. My predecessor in Riga, Rothert (1915), inserted into his list quite a few plants with question marks, but only a part of them was later found by me in my 20 years of work in Riga. Many of the doubtful species in St. Louis were hybrids.

In the following section each species is discussed in detail. The sequence of species follows Fernald's (1950) *Gray's Manual of Botany.* Fifty-five species are not mentioned in the *Manual*; they are included as seemed most appropriate. Previously unpublished Missouri taxa are printed in **boldface** type. Some species from Missouri based on old records were excluded from the *Flora of Missouri* by Steyermark (1963) as erroneously determined. Those now collected are treated as novelties and are also printed in **boldface** type. Species connected in the literature with my name, but which later proved to be something else are enclosed in [brackets]. The nomenclature often deviates from that of *Gray's Manual of Botany* and the *Flora of Missouri.* The names used were preferred by the specialists who determined the collections. In such cases the customarily used names are mentioned as synonyms. The same was done in other cases where it seemed appropriate. The naming of some cultigens presented difficulties. Anderson (1967) strongly opposed the use of such names as *Iris germanica* L. because of its unquestionably hybrid nature. Nevertheless, most floras use this name for this well-known ornamental and its escapes, so I decided to follow this practice.

For the largest group—the very rare plants (not more than 5 localities in 18 years)—the following information is given: my collecting number,[10] date(s), and the number of observed specimens. In case of taxa unpublished for Missouri the locality is given, as well as the name of the botanist who determined it. When a plant during these years was found in six or more localities, this information is not mentioned unless some extraordinary event seemed to merit some

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[10] Persons interested in exact localities may consult most of the relevant voucher specimens deposited at MO; a few specimens are deposited in other herbaria and the voucher information is followed by the acronym of that herbarium. For rare plants that were only observed, not collected, the full locality data is given in the text. Mühlenbach is abbreviated as *M*; different localities are separated by periods; collections from the same locality collected at different times are separated by semicolons.

TABLE 3. Distribution of synanthropes in the eight regions of St. Louis railroads (see also Table 1 and Fig. 1).

Taxa	Region							
	I	II	III	IV	V	VI	VII	VIII
GRAMINEAE								
Bromus inermis Leyss.	+	+	+	+	+	+	+	+
B. unioloides Kunth	+	+						
B. secalinus L.	+		+	+	+	+		
B. japonicus Thunb. subsp. *japonicus*	+	+	+	+	+			+
subsp. *subsquarrosus* (Borb.) Pénzes	+	+		+	+	+		
B. commutatus Schrad.	+	+	+	+	+	+	+	+
B. squarrosus L.	+		+					
B. rigidus Roth		+						
B. tectorum L.	+	+	+	+	+	+	+	+
Festuca rubra L. var. *commutata* Gaudin	+		+					
F. pratensis Huds.	+		+		+	+		+
F. arundinacea Schreb.	+	+	+	+	+	+	+	+
F. myuros L.			+		+			
Puccinellia distans (L.) Parl.			+					
P. airoides (Nutt.) Wats. & Coult.	+							
Poa annua L.	+			+	+			
P. compressa L.	+	+	+	+	+	+	+	+
Dactylis glomerata L.	+	+	+	+	+	+	+	+
Eragrostis curtipedicellata Buckley					+			
E. oxylepis (Torr.) Torr.		+						
E. multicaulis Steud.						+		
E. cilianensis (All.) E. Mosher	+	+	+	+	+	+	+	+
E. minor Host	+	+	+	+	+	+	+	+
E. barrelieri Daveau		+						
E. elliottii S. Wats.		+						
E. curvula (Schrad.) Nees			+					
Cynosurus echinatus L.			+					
Agropyron desertorum (Fisch.) Schult.		+						
A. repens (L.) Beauv.	+	+	+	+	+	+	+	+
A. elongatum (Host) Beauv.			+					
Aegilops cylindrica Host	+	+	+	+	+	+	+	+
Lolium perenne L.	+		+		+			+
L. multiflorum Lam.	+	+	+	+	+	+	+	+
L. persicum Boiss. & Hohen.	+	+						
L. rigidum Gaudin			+					
Hordeum jubatum L. var. *caespitosum* (Scribn.) Hitchc.		+						
H. vulgare L.	+	+	+	+	+	+		+
Triticum aestivum L.	+	+	+	+	+	+	+	+
Secale cereale L.	+	+	+	+	+	+	+	+
Holcus lanatus L.			+					
Avena fatua L.	+	+	+	+	+	+	+	+
A. sativa L.	+	+	+	+	+	+	+	+
Aira elegans Willd.			+					
Apera spica-venti (L.) Beauv.	+	+	+	+	+			
A. interrupta (L.) Beauv.	+							
Crypsis schoenoides (L.) Lam.	+	+			+			
Phleum pratense L.	+	+	+	+	+	+	+	+
Cynodon dactylon (L.) Pers.	+	+	+	+	+	+	+	+
Chloris virgata Swartz	+							
Eleusine indica (L.) Gaertn.	+	+	+	+	+	+	+	+
Leptochloa dubia (H.B.K.) Nees			+					
Phalaris canariensis L.	+	+	+		+			

TABLE 3. (Continued)

	Region							
Taxa	I	II	III	IV	V	VI	VII	VIII
GRAMINEAE (continued)								
Anthoxanthum odoratum L.	+							
Digitaria ischaemum (Schreb.) Schreb. ex Muhl.	+	+	+	+	+	+	+	+
D. sanguinalis (L.) Scop.	+	+	+	+	+	+	+	+
Eriochloa contracta Hitchc.	+							
Paspalum dilatatum Poir.		+						
P. urvillei Steud.	+	+						
Panicum geminatum Forsk.		+						
P. texanum Buckley	+							
P. miliaceum L.	+	+	+		+			
Echinochloa colonum (L.) Link	+	+	+					
E. crusgalli (L.) Beauv. f. *crusgalli*	+	+	+	+	+	+	+	+
f. *longiseta* (Trin.) Farw.	+	+	+	+	+	+	+	+
Setaria glauca (L.) Beauv.	+	+	+	+	+	+	+	+
S. verticillata (L.) Beauv. var. *verticillata*	+	+	+	+	+	+		+
var. *ambigua* (Guss.) Parl.			+	+				
S. viridis (L.) Beauv. var. *viridis*	+	+	+	+	+	+	+	+
var. *major* (Gaudin) Posp.		+						
S. faberi Herrm.	+	+	+	+	+	+	+	+
S. italica (L.) Beauv.	+		+					
Pennisetum ciliare (L.) Link		+						
Miscanthus sinensis Anderss.	+				+	+		+
Erianthus ravennae (L.) Beauv.	+							
Sorghum halepense (L.) Pers.	+	+	+	+	+	+	+	+
S. bicolor (L.) Moench	+	+	+	+	+	+		+
S. dochna (Forsk.) Snowden var. *technicum* (Koern.) Snowden	+	+						
Zea mays L.	+	+	+	+	+	+	+	+
CYPERACEAE								
Carex nebraskensis Dewey	+							
COMMELINACEAE								
Commelina communis L.	+	+	+	+	+	+	+	+
JUNCACEAE								
Juncus gerardii Loisel.					+			
LILIACEAE								
Allium sativum L.	+		+	+	+	+	+	+
A. vineale L. f. *vineale*	+	+	+	+	+	+	+	+
f. *compactum* (Thuill.) Aschers.	+	+						
A. cepa L. var. *cepa*		+						
var. *viviparum* Metz				+				
Hemerocallis fulva L. var. *fulva*	+	+	+	+	+	+	+	+
var. *kwanso* Regel	+			+				+
Ornithogalum umbellatum L.						+		+
Muscari botryoides (L.) Mill.							+	
Yucca filamentosa L.							+	
Asparagus officinalis L.	+	+		+	+	+	+	+
AMARYLLIDACEAE								
Narcissus × *biflorus* Curtis								+
IRIDACEAE								
Iris germanica L.	+						+	+

TABLE 3. (Continued)

Taxa	Region							
	I	II	III	IV	V	VI	VII	VIII
ULMACEAE								
Ulmus pumila L.	+	+	+	+	+	+	+	+
MORACEAE								
Morus alba L.	+	+	+	+	+	+	+	+
Broussonetia papyrifera (L.) Vent.				+				
Maclura pomifera (Raf.) Schneid.	+	+		+	+	+		+
CANNABINACEAE								
Cannabis sativa L.		+		+	+			
Humulus japonicus Sieb. & Zucc.	+	+	+	+	+	+	+	+
POLYGONACEAE								
Rumex patientia L.	+	+	+	+	+	+	+	+
R. crispus L.	+	+	+	+	+	+	+	+
R. pulcher L.		+	+					
R. obtusifolius L.			+	+	+			+
R. stenophyllus Ledeb.	+	+		+	+			
R. dentatus L.	+							
R. acetosella L.	+	+	+	+	+	+	+	+
Polygonum pensylvanicum L. var. *rosaeflorum* J. B. S. Norton	+	+		+		+		
P. lapathifolium L. var. *prostratum* Wimm.			+					
P. scabrum Moench	+	+						
P. orientale L.					+			
P. cespitosum Blume var. *longisetum* (DeBruyn) Stewart	+		+		+		+	+
P. persicaria L. f. *persicaria*	+	+	+	+	+	+	+	+
f. *albiflora* Millsp.		+						
P. convolvulus L.	+	+	+	+	+	+	+	+
P. cuspidatum Sieb. & Zucc.	+	+	+	+	+	+		+
Fagopyrum sagittatum Gilib.	+	+	+		+		+	
CHENOPODIACEAE								
Kochia scoparia (L.) Schrad.	+	+	+	+	+	+	+	+
K. iranica (Hausskn. &. Bornm.) Litw.	+							
Chenopodium murale L.	+					+		
C. botrys L.	+	+	+	+	+	+		+
C. ambrosioides L.	+	+	+	+	+	+		+
C. pumilio R. Br.	+	+						
C. glaucum L. var. *glaucum*	+							
var. *salinum* (Standley) Boivin	+							
C. watsonii A. Nelson	+							
C. opulifolium Schrad.					+			
Atriplex rosea L.	+							
A. truncata (Torr.) Gray	+		+					
A. heterosperma Bunge						+		
Salsola kali L. var. *tenuifolia* Tausch	+	+	+		+	+		+
S. collina Pall.	+	+	+		+	+		
Beta vulgaris L.					+			
AMARANTHACEAE								
Celosia cristata L.	+			+			+	
Amaranthus palmeri S. Wats.	+	+	+	+	+			+
A. arenicola I. M. Johnston	+	+						
A. hybridus L.	+	+	+	+	+	+	+	+
A. retroflexus L.	+	+	+	+	+	+	+	+

TABLE 3. (Continued)

Taxa	Region							
	I	II	III	IV	V	VI	VII	VIII
AMARANTHACEAE (continued)								
A. powellii S. Wats.	+	+	+			+		
A. spinosus L.	+	+	+		+			
A. tricolor L.							+	
AIZOACEAE								
Mollugo verticillata L.	+	+	+	+	+	+	+	+
PORTULACACEAE								
Portulaca oleracea L.	+	+	+	+	+	+	+	+
P. grandiflora Hook.	+	+	+	+			+	+
CARYOPHYLLACEAE								
Arenaria serpyllifolia L.	+	+		+	+	+		+
Stellaria media (L.) Cyrillo	+	+	+	+	+	+	+	+
Cerastium holosteoides Fries subsp. *triviale* (Link) Möschl f. *glandulosum* (Boenn.) Möschl	+	+			+		+	+
C. glomeratum Thuill.					+			
C. semidecandrum L.				+				
C. pumilum Curtis f. *pumilum*	+	+			+		+	
f. *medium* Möschl			+		+	+		+
Holosteum umbellatum L.	+			+				+
Agrostemma githago L.	+	+	+	+	+	+		+
Lychnis alba Mill.	+	+	+	+	+			
Silene cucubalus Wibel	+	+	+					
S. cserei Baumg.		+		+	+			
S. armeria L.							+	
S. conoidea L.	+	+	+					
S. dichotoma Ehrh.		+						
S. gallica L.	+							
S. noctiflora L.	+	+	+		+			
Saponaria officinalis L.	+	+	+	+	+	+	+	+
S. vaccaria L.	+	+	+		+	+		
Dianthus armeria L.	+	+			+	+		
RANUNCULACEAE								
Ranunculus acris L.					+			
R. sardous Crantz	+					+		
R. arvensis L.	+							
Clematis dioscoreifolia Lévl. & Vaniot	+				+		+	
Delphinium ajacis L.	+	+	+	+	+	+	+	+
D. consolida L.		+						
PAPAVERACEAE								
Eschscholtzia californica Cham.	+							
Argemone albiflora Hornem.	+	+						
CAPPARACEAE								
Cleome hassleriana Chod.	+							
CRUCIFERAE								
Berteroa incana (L.) DC.	+							
Lobularia maritima (L.) Desv.							+	
Thlaspi arvense L.	+	+	+	+	+	+	+	+
Lepidium perfoliatum L.	+	+	+	+				
L. campestre (L.) R. Br.	+	+	+	+	+	+		+
Cardaria draba (L.) Desv.				+	+			

TABLE 3. (Continued)

	Region							
Taxa	I	II	III	IV	V	VI	VII	VIII
CRUCIFERAE (continued)								
C. pubescens (C. A. Mey.) Rollins								
var. *elongata* Rollins	+	+	+					
Capsella bursa-pastoris (L.) Medic.	+	+	+	+	+	+	+	+
Camelina microcarpa Andrz.	+	+	+	+	+	+		
Neslia paniculata (L.) Desv.	+	+						
Raphanus raphanistrum L.	+	+	+		+	+		
R. sativus L.	+	+						
Brassica hirta Moench	+	+	+		+	+		+
B. kaber (DC.) L. C. Wheeler	+	+	+	+	+	+	+	+
B. juncea (L.) Coss. var. *juncea*	+	+	+	+	+			+
var. *crispifolia* Bailey	+	+	+					
B. nigra (L.) Koch	+		+		+			
B. rapa L.	+	+	+	+		+	+	
B. napus L. var. *napobrassica* (L.) Peterm.			+	+				
Erucastrum gallicum (Willd.) O. E. Schulz	+	+		+	+	+		
Conringia orientalis (L.) Dumort.	+	+	+	+	+			
Sisymbrium officinale (L.) Scop.								
var. *leiocarpum* DC.	+	+	+		+			
S. altissimum L.	+	+	+	+	+	+		+
S. loeselii L.	+	+	+					
Arabidopsis thaliana (L.) Heynh.	+	+			+			
Descurainia sophia (L.) Webb	+	+	+	+	+	+		
Erysimum repandum L.	+	+	+	+	+	+	+	+
Barbaraea vulgaris R. Br.	+		+	+	+	+		+
Chorispora tenella (Pall.) DC.	+	+	+		+	+		
CRASSULACEAE								
Sedum sarmentosum Bunge							+	+
SAXIFRAGACEAE								
Philadelphus coronarius L.								+
ROSACEAE								
Pyrus communis L.					+			
P. malus L.		+	+		+			+
P. baccata L.					+			
Fragaria × *ananassa* Duchesne					+			
Potentilla argentea L.			+					
P. recta L.	+	+	+	+	+	+		+
Rubus bifrons Vest								+
Rosa multiflora Thunb.		+	+	+	+	+	+	+
R. rugosa Thunb.								+
Prunus persica (L.) Batsch	+	+	+	+	+	+	+	+
P. armeniaca L.		+						
LEGUMINOSAE								
Cassia occidentalis L.	+							
Trifolium incarnatum L.					+			
T. pratense L. f. *pratense*	+	+	+	+	+	+	+	+
f. *leucochraceum* Aschers. & Prantl								+
T. repens L.	+	+	+	+	+	+	+	+
T. hybridum L.	+	+	+	+	+	+		+
T. campestre Schreb.			+		+			
T. dubium Sibth.					+		+	

TABLE 3. (Continued)

Taxa	Region							
	I	II	III	IV	V	VI	VII	VIII
LEGUMINOSAE (continued)								
Melilotus officinalis (L.) Lam. f. *officinalis*	+	+	+	+	+	+	+	+
f. *confertus* O. E. Schulz				+				
M. albus Desr.	+	+	+	+	+	+	+	+
Medicago sativa L.	+	+	+		+	+	+	+
M. lupulina L. var. *lupulina*	+	+		+	+	+	+	+
var. *glandulosa* Neilr.	+	+	+	+	+	+	+	+
M. polymorpha L. var. *vulgaris* (Benth.) Shinners		+						
Coronilla varia L.					+			
Lespedeza cuneata (Dumont) G. Don			+		+			
L. striata (Thunb.) H. & A.					+			
L. stipulacea Maxim.	+	+	+	+	+	+		+
L. bicolor Turcz.					+			
Vicia sativa L. var. *nigra* L.	+							
V. cracca L.	+							
V. villosa Roth	+	+	+	+		+		
V. dasycarpa Ten.			+	+	+		+	
Lathyrus hirsutus L.		+			+			
L. latifolius L.	+			+	+		+	+
Pisum sativum L. var. *sativum*	+							
var. *arvense* (L.) Poir.						+		
Phaseolus vulgaris L. var. *humilis* Alef.	+							
P. lunatus L. var. *lunonanus* Bailey		+						
Glycine max (L.) Merr.	+	+	+	+	+	+	+	+
LINACEAE								
Linum usitatissimum L.	+	+	+		+	+		
OXALIDACEAE								
Oxalis priceae Small subsp. *texana* (Small) Eiten							+	
GERANIACEAE								
Erodium cicutarium (L.) L'Hér.	+							
E. texanum Gray	+							
ZYGOPHYLLACEAE								
Tribulus terrestris L.	+	+	+	+	+	+	+	+
SIMAROUBACEAE								
Ailanthus altissima (Mill.) Swingle	+	+	+	+	+	+	+	+
EUPHORBIACEAE								
Croton texensis (Klotzsch) Muell. Arg.	+							
C. lindheimerianus Scheele					+			
Ricinus communis L.	+	+			+			
Chamaesyce prostrata (Ait.) Small	+		+					
ANACARDIACEAE								
Rhus typhina L. f. *dissecta* Rehder					+			
CELASTRACEAE								
Euonymus fortunei (Turcz.) Hand.-Maz. var. *radicans* Rehder					+			
BALSAMINACEAE								
Impatiens balsamina L.							+	

TABLE 3. (Continued)

	Region							
Taxa	I	II	III	IV	V	VI	VII	VIII
VITACEAE								
Parthenocissus tricuspidata (Sieb. & Zucc.) Planch.					+			+
Vitis labruscana Bailey				+				
MALVACEAE								
Malva sylvestris L.							+	
M. neglecta Wallr.			+					
M. rotundifolia L.	+		+			+		
Alcea rosea L.	+	+	+	+	+	+	+	+
Anoda cristata (L.) Schlecht.			+					
Sida spinosa L.	+	+	+	+	+	+	+	+
Abutilon theophrasti Medic.	+	+	+	+	+	+	+	+
Hibiscus syriacus L.				+	+			
H. trionum L.	+	+	+					
Gossypium hirsutum L.	+	+						
STERCULIACEAE								
Melochia corchorifolia L.		+						
GUTTIFERAE								
Hypericum perforatum L.	+			+	+			+
TAMARICACEAE								
Tamarix gallica L.					+			
VIOLACEAE								
Viola tricolor L.								+
V. kitaibeliana R. & S. var. *rafinesquii* (Greene) Fern.	+	+		+	+	+	+	+
ONAGRACEAE								
Oenothera kunthiana (Spach) Munz		+						
Gaura sinuata Nutt. ex Ser.	+							
ARALIACEAE								
Hedera helix L.					+			
UMBELLIFERAE								
Anthriscus scandicina (Weber) Mansf.			+					
Torilis arvensis (Huds.) Link	+	+	+	+	+	+	+	+
T. nodosa (L.) Gaertn.		+						
Coriandrum sativum L.		+						
Conium maculatum L.	+	+		+				+
Apium graveolens L.		+						
Ammi majus L.		+						
Anethum graveolens L.		+						
Pastinaca sativa L.	+	+	+		+	+	+	+
Daucus carota L.	+	+	+	+	+	+	+	+
PRIMULACEAE								
Anagallis arvensis L.	+	+	+		+			
LOGANIACEAE								
Buddleia davidii Franch.					+			
ASCLEPIADACEAE								
Asclepias subverticillata (Gray) Vail		+						

TABLE 3. (Continued)

Taxa	Region							
	I	II	III	IV	V	VI	VII	VIII
CONVOLVULACEAE								
Ipomoea coccinea L.		+		+	+			+
I. hederacea (L.) Jacq. var. *hederacea*	+	+	+	+	+	+	+	+
var. *integriuscula* Gray	+	+	+	+				
I. purpurea (L.) Roth var. *purpurea*	+	+	+	+	+	+	+	+
var. *diversifolia* (Lindl.) O'Donell								+
I. cairica (L.) House	+							
Jacquemontia tamnifolia (L.) Griseb.		+	+					
Convolvulus pellitus Ledeb. f. *anestius* Fern.	+				+			
C. arvensis L.	+	+	+	+	+	+	+	+
Cuscuta indecora Choisy var. *neuropetala* (Engelm.) Hitchc.		+						
BORAGINACEAE								
Heliotropium indicum L.	+							
Echium vulgare L.	+							
Lithospermum arvense L.	+	+	+	+	+	+	+	+
Amsinckia lycopsoides Lehm.	+	+	+					
A. hispida (R. & P.) Johnston	+							
A. tesselata Gray	+			+				
Lappula echinata Gilib.	+	+			+	+		
L. redowskii (Hornem.) Greene var. *redowskii*	+							
VERBENACEAE								
Verbena brasiliensis Vell.				+				
V. halei Small	+	+						
LABIATAE								
Nepeta cataria L.	+	+	+		+			
Glechoma hederacea L. var. *micrantha* Moricand			+			+	+	+
Dracocephalum parviflorum Nutt.	+		+					
Leonurus cardiaca L.	+	+		+	+	+	+	+
Galeopsis tetrahit L.	+	+				+		
Lamium amplexicaule L. f. *amplexicaule*	+	+	+	+	+	+	+	+
f. *clandestinum* (Reichenb.) G. Beck	+	+		+	+	+	+	+
L. purpureum L.				+	+		+	+
Mentha spicata L.			+					
M. × *gentilis* L.	+	+		+				+
Perilla frutescens (L.) Britt.	+	+			+	+		
Ocimum basilicum L.	+							
SOLANACEAE								
Solanum tuberosum L.	+	+	+					
S. sarachoides Sendtner		+						
S. rostratum Dunal	+	+	+	+	+			+
Lycopersicum esculentum Mill.	+	+	+	+	+	+	+	
Physalis viscosa L. var. *cinerascens* (Dunal) Waterfall	+							
P. acutifolia (Miers) Sandw.	+							
Lycium halimifolium Mill.	+	+	+	+	+	+	+	+
Datura stramonium L. var. *stramonium*	+	+	+	+	+	+		+
var. *tatula* (L.) Torr.	+							
D. innoxia Mill.	+		+		+		+	
Petunia axillaris (Lam.) B. S. P.	+							
P. × *atkinsiana* D. Don	+			+	+			+

TABLE 3. (Continued)

Taxa	Region I	II	III	IV	V	VI	VII	VIII
SCROPHULARIACEAE								
Verbascum thapsus L.	+	+	+	+	+	+	+	+
V. blattaria L. f. *blattaria*	+	+	+	+	+	+		+
f. *erubescens* Brugger	+	+	+	+	+	+		+
Kickxia elatine (L.) Dumort.	+		+	+	+			+
Linaria vulgaris Hill	+	+					+	+
Antirrhinum majus L.	+							
Chaenorrhinum minus (L.) Lange	+	+			+	+		
Paulownia tomentosa (Thunb.) Steud.								+
Veronica arvensis L.	+	+	+	+	+	+	+	+
V. polita Fries							+	
BIGNONIACEAE								
Catalpa bignonioides Walt.					+			
PEDALIACEAE								
Sesamum orientale L.		+						
PLANTAGINACEAE								
Plantago major L.		+	+		+			+
P. lanceolata L.	+	+	+	+	+	+	+	+
P. wrightiana Dcne.	+				+			
CAPRIFOLIACEAE								
Lonicera xylosteum L.					+			
L. morrowii Gray								+
L. japonica Thunb.	+		+	+	+	+	+	+
DIPSACACEAE								
Dipsacus sylvestris Huds.	+					+		
CUCURBITACEAE								
Cucurbita pepo L. var. *ovifera* (L.) Alef.	+		+					
Cucumis melo L.	+	+	+					
C. sativus L.	+							
Citrullus lanatus (Thunb.) Mansf.	+	+	+	+	+	+	+	
Lagenaria siceraria (Molina) Standley					+		+	+
CAMPANULACEAE								
Campanula rapunculoides L.							+	
COMPOSITAE								
Eupatorium capillifolium (Lam.) Small	+				+			
Grindelia squarrosa (Pursh) Dunal var. *serrulata* (Rydb.) Steyerm.	+							
Gutierrezia texana (DC.) T. & G.	+							
Franseria discolor Nutt.	+							
Ratibida tagetes (James) Barnhart	+							
Verbesina encelioides (Cav.) B. & H. var. *exauriculata* Robins. & Greenm.	+	+	+		+			
Coreopsis cardaminefolia (DC.) T. & G.	+							
Bidens coronata (L.) Britt.	+							
B. pilosa L. var. *radiata* Schz.-Bip.	+							
Cosmos bipinnatus Cav.	+							
C. parviflorus (Jacq.) Pers.	+							
Galinsoga ciliata (Raf.) Blake	+	+						
Gaillardia pulchella Foug.	+						+	
Tagetes patula L.	+				+			

TABLE 3. (Continued)

Taxa	Region							
	I	II	III	IV	V	VI	VII	VIII
COMPOSITAE (continued)								
Achillea millefolium L.	+	+	+	+	+	+	+	+
Anthemis cotula L.	+	+	+		+	+		
A. arvensis L.	+	+		+				
Matricaria chamomilla L.	+		+	+	+			
M. matricarioides (Less.) Porter	+	+	+					
Chrysanthemum leucanthemum L.	+	+	+		+	+	+	+
Tanacetum vulgare L.	+							
Artemisia biennis Willd.	+		+					
A. vulgaris L.	+	+	+					
A. absinthium L.	+							
Senecio vulgaris L.	+							
S. ampullaceus Hook.		+						
Arctium minus (Hill) Bernh.	+	+	+	+	+	+		+
Carduus nutans L.	+	+	+	+	+	+		+
Cirsium vulgare (Savi) Ten.	+	+	+	+	+	+		+
C. arvense (L.) Scop.	+	+			+			+
C. texanum Buckley					+			
Centaurea solstitialis L.	+							
C. diffusa Lam.	+							
C. cyanus L.	+	+	+	+	+	+	+	+
C. nigra L.		+						
C. stoebe L. subsp. *stoebe*		+						
C. maculosa Lam.					+			
C. diluta Ait.			+					
Cichorium intybus L. f. *intybus*	+	+	+	+	+	+	+	+
f. *albus* Neum.					+			
Hypochaeris radicata L.	+							
Picris hieracioides L.				+				
P. echioides L.			+					
Tragopogon pratensis L.					+			
T. dubius Scop.	+	+	+	+	+	+	+	+
Taraxacum officinale Weber	+	+	+	+	+	+	+	+
Sonchus arvensis L. var. *glabrescens* Guenth.	+	+	+		+	+		
S. oleraceus L.	+	+	+	+	+	+	+	+
S. asper (L.) Hill	+	+	+	+	+	+	+	+
Lactuca serriola L.	+	+	+	+	+	+	+	+
L. saligna L.			+			+		
Crepis pulchra L.	+							
C. tectorum L.	+							

discussion. The degree of frequency is given as: common, frequent, scattered, rare. Widespread (occurrence in all 8 regions), or quite widespread (occurrence in 7 regions) is also indicated.

Persistence and naturalization is estimated. In cases of accepted persistence the first and the last years when the plant in question was seen are given. In many cases no records exist for some intermediate years, usually because the location was not visited in those years. The discussion of each species, with the exception of most of the ergasiophygophytes, ends with a reference to its origin. Numerous adventive botanists have given detailed descriptions of the native as well as the adventive occurrences of observed plants, but I believe that this does not make much sense now, as one often has to reckon with second- and third-hand or further-removed introductions. Therefore, with some exceptions, continents only are mentioned. Mostly the data of *Gray's Manual of Botany* and Komarov's (1933–1964) *Flora of the U.S.S.R.* are used. For quite a few species the place of origin is uncertain. Some are cosmopolitan, spread more or less over the whole world, and for this reason there is disagreement about their original distribution.

GRAMINEAE

Bromus inermis Leyss.

Widespread, locally scattered, persisting in many places. One unusual case greatly helped expansion of this species. During the last decade the U.S. Corps of Engineers built the St. Louis floodwall which, for the most part, runs along the railroad. It is a stone structure to which an earth embankment was added in some places, especially along roadways leading to the railroad. In such places grew huge, luxuriant colonies of this species. An inquiry to the headquarters confirmed the suspicion that the slopes there were sown. The seed mixture used was over 50% "Smooth Brome Grass (southern strain)" by weight. Naturalized. Eurasia.

Bromus unioloides Kunth (*B. catharticus* Vahl)

Rare, observed in 2 regions in 6 localities 16 times, mostly as a few or even 1 or 2 specimens. There was a tendency to reappear in the same locality after it was missed for a year or so. The longest observation period was 7 years. Repeated introductions are less likely to have occurred rather than the failure of germination. Seen last in 1963. South America.

The next four *Bromus* species presented many difficulties in identification. Hitchcock (1950) already pointed out that some of these species are differentiated only by arbitrary characters. All doubtful *Bromus* material was sent for determination to H. Scholz (Berlin). See also his latest treatment (Scholz, 1970). The collections were made at random to get different looking specimens. With the exception of *B. squarrosus*, all species were frequent or scattered, *B. commutatus* being the most widespread. All four species are of Eurasiatic origin.

Bromus secalinus L.

Scattered, observed in 5 regions.

Bromus japonicus Thunb.

Quite widespread, locally frequent, almost half of the collections belong to subsp. **subsquarrosus** (Borb.) Pénzes.

Bromus commutatus Schrad. (*B. racemosus* L.)

Widespread, locally frequent.

Bromus squarrosus L.

M 954, 17 June 1956, 1 specimen. *M 1255B*, 4 July 1957, 2 specimens.

Bromus rigidus Roth

M 614, 30 May 1955, 1 specimen. Eurasia.

Bromus tectorum L.

Widespread, locally common, frequently in large pure stands with high density. Flowering begins in mid April; the last stragglers can be seen in August. Then the plant, which is so dominant in June and July, disappears almost completely. Naturalized. Eurasia.

Festuca rubra L. var. *commutata* Gaudin

M 1415, 7 June 1958, 1 small colony. *M 1430*, 28 June 1958, 1 large tuft. Northeastern U.S. and Eurasia.

Festuca pratensis Huds. (*F. elatior* L.)

Unexpectedly rare, found 14 times, including 6 unicates, in 5 regions. No persistence was ever observed. Eurasia.

Festuca arundinacea Schreb.

Widespread, locally frequent. Apparently strongly expanding; almost pure and persistent stands have developed on quite a few large, weedy, open lots and on margins of the railroad right-of-ways and the yards, but it was quite seldom found on the tracks. It is sometimes not recognized as a species because of intergradation with *F. pratensis*. Fernald (1950) does not mention it at all, but Pohl (1966) and Terrell (1968), among others, recognize both. *Festuca arundinacea* is considerably taller. One character deserves to be emphasized—the lowest branch of the inflorescence bears 1–2 spikelets in *F. elatior*, but (3–)5–8(–20) in *F. arundinacea*. Naturalized. Europe.

Festuca myuros L.

M 928, 9 June 1956, 1 specimen; *M 1194*, 2 June 1957, 1 colony. *M 949*, 17 June 1956, 1 specimen. Eurasia.

Puccinellia distans (L.) Parl.

M 70, 23 May 1954, 2 specimens. Eurasia.

Puccinellia airoides (Nutt.) Wats. & Coult.

M 1179, 1 June 1957, 2 specimens. Western U.S.

Poa annua L.

M 880, 5 May 1956, 1 colony. *M 1192*, 2 June 1957, few specimens. *M 1939*, 13 May 1962, 1 colony. *M 3246*, 15 May 1970, 1 colony. Unexpectedly rare, now and then mistaken for the more frequent native *P. chapmaniana* Scribn. Eurasia.

Poa compressa L.

Widespread, locally scattered, always in dense colonies and in many places persistent. Naturalized. Eurasia.

Dactylis glomerata L.

Widespread, common locally, sometimes the colonies were huge. Naturalized. Eurasia.

Eragrostis curtipedicellata Buckley

M 1993, Lindenwood Fr. Yd., 23 July 1962, 1 small colony. Not a new, but now a certain adventive for Missouri. Steyermark (1963: 107, 112) excluded this species from the *Flora of Missouri*. The new collection was determined by L. H. Harvey. According to him, the range of this prairie species is from southern Kansas to Coahuila, Mexico, and it has not been reported previously as a waif in railroad yards.

Eragrostis oxylepis (Torr.) Torr.

M 1931, 29 Oct. 1961, 1 small colony. Although several plants were left and no direct threats to its survival were apparent, no trace of this plant could be detected the next year. Southern and western U.S.

[*Eragrostis pilosa* (L.) Beauv.]

Cited in the *Flora of Missouri*, p. 107, it is, according to L. H. Harvey, the native *E. pectinacea* (Michx.) Nees.

Eragrostis multicaulis Steud.

M 3723, TRRA, E of Geraldine Ave., 3 Nov. 1971, 1 specimen. Determined by L. H. Harvey. According to Harvey, it is the first report of this Eurasian species from the Mississippi Valley. It is rapidly spreading in the northeastern U.S.

Eragrostis cilianensis (All.) E. Mosher (*E. megastachya* (Koel.) Link)

Widespread, locally scattered. In the juvenile stage it is difficult to distinguish from the next species. Steyermark (1963) described *E. cilianensis* as much more common in the state than *E. minor*. However, just the opposite is true in the St. Louis railroads. Eurasia.

Eragrostis minor Host

Widespread, locally frequent. Its colonies were often huge, but many specimens were dwarf. Naturalized. Eurasia.

Eragrostis barrelieri Daveau

M 2732, K Line Fr. Yd., 18 Sep. 1966, 1 large tuft. *M 3071*, Bremen Fr. Yd., 31 Oct. 1968, 2 tufts. Determined by L. H. Harvey. South European, it has already been found in quite a few southwestern states.

Eragrostis elliottii S. Wats.

M 3183, St. Louis Ave. Fr. Yd., 4 Oct. 1969, 1 specimen. Determined by L. H. Harvey. According to Harvey, its range includes the Gulf and Atlantic Coastal Plain states; also, no other reports about its occurrence as waif in railroad yards are known.

Eragrostis curvula (Schrad.) Nees

M 2955, 4 July 1968, 1 tuft. Of South African origin, according to L. H. Harvey, and planted for pasture and for erosion control on road cuts in the Southeast and Southwest. In St. Louis it is most likely an introduction.

Cynosurus echinatus L.

M 1628, 5 June 1960, 1 specimen. Eurasia.

Agropyron desertorum (Fisch.) Schult.

M 2471, St. Louis Ave. Fr. Yd., 31 May 1965, 1 large specimen. Determined by R. W. Pohl. According to Hitchcock (1950), extensively planted in the northern Great Plains area and found in grain fields in quite a few northwestern states. Introduced from Russia.

Agropyron repens (L.) Beauv.

Widespread, locally scattered, always in quite dense colonies but not especially large in extent. Naturalized. Europe, also along the North Atlantic coast of U.S.

Agropyron elongatum (Host) Beauv.

M 2956, Lesperance St. Fr. Yd. (MP), 4 July 1968, 1 small tuft. Determined by R. W. Pohl. Grown with success in the Wyoming Agricultural Experiment Station (Beetle, 1955). Eurasia.

Aegilops cylindrica Host

Widespread, locally scattered, mostly in small colonies, although sometimes, especially in the first years of the study, only a few or even unicate specimens were seen. Naturalized. Eurasia.

Lolium perenne L.

Rare, only 8 collections in 4 regions. In Missouri as a whole *L. perenne* and *L. multiflorum* are equally frequent (Steyermark, 1963), but in the St. Louis railroads *L. perenne* is much rarer than *L. multiflorum*. Eurasia.

Lolium multiflorum Lam.

Widespread, locally frequent, mostly in colonies, especially on margins, but also on the tracks. Sometimes sown (E of the Pickrel Fr. Yd. 1971) on bare slopes and embankments after construction. Naturalized. Eurasia.

[*Lolium temulentum* L. var. *temulentum*]

Cited in the *Flora of Missouri*, p. 136, it is, according to G. Davidse, *L. persicum* Boiss. & Hohen.

[*Lolium temulentum* L. var. *macrochaeton* A. Br.]

Cited in the *Flora of Missouri*, p. 136, it is, according to H. Scholz, *L. rigidum* Gaudin.

Lolium persicum Boiss. & Hohen.

Rare, observed in 2 regions 6 times, on 2 occasions several colonies at a time. It is a true ephemerophyte, never appearing the next year. Asia.

Lolium rigidum Gaudin

M 1411, Lesperance St. Fr. Yd. (MP), 7 June 1958, 1 specimen. Determined by H. Scholz. It is a monstrosity, sometimes also found in *L. perenne*. The spikes are, for the most part, branched. Eurasia.

Hordeum jubatum L. var. *caespitosum* (Scribn.) Hitchc.

M 995, 4 July 1956, 4 specimens. The typical variety is native to Missouri and widespread on the railroad. The range of the introduced variety is, according to Hitchcock (1950), North Dakota to Alaska, south to California and Arizona.

Hordeum vulgare L.

Quite widespread, locally scattered, even rare in the beginning of this study. Among the cultivated grains observed on the railroad, barley was the rarest. Mostly on the tracks as a few specimens, but sometimes as unicates or colonies.

Triticum aestivum L.

The most common of the cultivated grain cereals on the railroad. It frequently grew in large colonies; the surroundings of some grain elevators were especially rich, but wheat also grew in quantity along many classification tracks. It was common to see mounds of wheat grain lying along the tracks, and this often attracted clouds of pigeon.

Secale cereale L.

It was the second most frequently found cultivated grain. Although widespread, rye was much rarer than wheat but behaved much the same on the railroad.

Holcus lanatus L.

M 1637, 5 June 1960; *M 1670*, 17 July 1960, both as a few specimens. *M 2948*, 4 July 1968, 3 specimens. Eurasia.

Avena fatua L.

Widespread, locally scattered, in many cases found as unicates. Eurasia.

Avena sativa L.

Widespread, more frequent locally than the previous species. Oats were less common than wheat and rye but were decidedly more frequent than barley.

Aira elegans Willd.

M 885, 13 May 1956, 1 colony. It was later destroyed by construction work. Eurasia.

Apera spica-venti (L.) Beauv. (*Agrostis spica-venti* L.)

This is a rapidly spreading plant, although not over the entire railroad area. First discovered on 5 June 1954 in Region 2 (*M 112*), the next year it was collected 8 times in Regions 1–4 along the Mississippi River. The center of the expansion was apparently the North St. Louis Yd., which is quite near the site of the original colony. In later years it was rated here as a common plant. *Apera spica-venti* also grew in the neighboring yards (Luther, Baden, Harlem, Carrie Ave., Bremen), but it was not as common. It advanced south as well, but showed no tendency to move along the western lines. It was found only once in Region 5. Naturalized. Eurasia.

Apera interrupta (L.) Beauv. (*Agrostis interrupta* L.)

M 1959, 30 May 1962, 1 colony. Eurasia.

Crypsis schoenoides (L.) Lam.

M 668, 4 July 1955, 1 colony, also observed 11 Aug. 1957 and 7 Sep. 1958. *M 1089*, 15 Sep. 1956, 1 colony. Also observed SL-SF, 39th St., 17 July 1955, 1 specimen. TRRA north of North Market St., 20 Aug. 1955, 1 specimen. N&W, Luther Fr. Yd., 28 Aug. 1955. It is remarkable that after this plant was found from 1955 to 1958 in 5 localities and in one of these localities for several years, it was never observed again after 1959. In spite of its small size, this grass is quite conspicuous, and it is hardly conceivable that it would later be constantly overlooked. Europe.

Phleum pratense L.

Widespread, locally frequent, always in colonies but mostly of modest size. Suspiciously frequent on the embankment of the St. Louis floodwall, but it could not be ascertained whether this frequently cultivated grass had also been intentionally sown there. Naturalized. Eurasia.

Cynodon dactylon (L.) Pers.

Widespread, locally scattered, remarkable were the huge, persistent colonies, sometimes in almost pure stands. It occurred mostly on the margins and open plots of the yards or along trunk lines, but rarely on the tracks. Bermuda grass is frequently used in lawns, so there is the possibility that at least in some cases it was only a garden escape. Naturalized. Eurasia.

Chloris virgata Swartz

M 1002, 8 July 1956, 1 specimen. Southern and western U.S.

Eleusine indica (L.) Gaertn.

Widespread, locally frequent. The distribution of this grass on the railroads in St. Louis is very unusual and curious; it was found almost completely on and along the many streets and roads which traverse the freight yards. Only in a few cases was it found on tracks far away from roads. This grass is frequent on the streets and sidewalks of the city, where it endures trampling very well. It is evident that this grass is spread by trucks and not by railroad traffic. See also Frenkel (1970) for the dissemination of ruderals in California by trucks. Naturalized. Tropical Asia and Africa.

Leptochloa dubia (H.B.K.) Nees

M 2407, Lesperance St. Fr. Yd. (MP), 1 Aug. 1964, 1 small colony. Determined by L. H. Harvey. Southern and western U.S.

Phalaris canariensis L.

Rare, observed in 4 regions 8 times, mostly 1–3 specimens, sometimes as small colonies. Last seen 1964. Europe.

Anthoxanthum odoratum L.

M 3313, 21 June 1970, few specimens. Eurasia.

Digitaria ischaemum (Schreb.) Schreb. ex Muhl.

Although found in all 8 regions, the plant could by no means be called common or even frequent. Its occurrence was very often as rare, and it was frequently found only as 1 or 2 specimens. It began to flower especially late in the season, mostly in September (only once at the end of July). Europe.

Digitaria sanguinalis (L.) Scop.

Widespread, locally common. Possibly the most frequent adventive, occurring almost everywhere. It began to flower quite late, in comparison with many other grasses, usually in the last quarter of June, or rarely in the first week of June. It continued to flower into November. Naturalized. Eurasia.

Eriochloa contracta Hitchc.

M 1066, 3 Sep. 1956, 1 colony. *M 3163*, 28 Sep. 1969, 1 colony; *M 3645*, 29 July 1971, 1 colony; *M 3687*, 2 Oct. 1971, 2 specimens. Southern and western U.S.

Paspalum dilatatum Poir.

M 1355, 8 Sep. 1957, also observed 26 July 1958; *M1478*, Sep. 1958, all several specimens. *M 2557*, 26 Sep. 1965, 1 specimen. South America.

Paspalum urvillei Steud.

M 1848, 9 Sep. 1961, 1 huge tuft. *M 3070*, 31 Oct. 1968, 1 large tuft. South America.

Panicum geminatum Forsk. (*Paspalidium geminatum* (Forsk.) Stapf)

M 1246, 30 June 1957; *M 1354*, 8 Sep. 1957; *M 1478*, 1 Sep. 1958, all the same plant. Southern U.S.

Panicum texanum Buckley

M 517, 22 Oct. 1954, few specimens. Southern U.S.

Panicum miliaceum L.

Rare, observed in 4 regions 10 times, in the majority (6) of cases as unicates. Broomcorn millet is cultivated to a limited extent in the cooler parts of the U.S., but not in Missouri. In St. Louis it is therefore not an escape, but a true adventive.

Echinochloa colonum (L.) Link

M 224, 5 July 1954, 1 small colony, also observed July–Sep. 1955. *M 1688*, 14 Aug. 1960, 1 specimen. *M 2400*, 26 July 1964, 1 colony. *M 2421*, 16 Aug. 1964, 1 specimen. *M 3186*, 5 Oct. 1969, 3 specimens. Tropical regions of both hemispheres.

Echinochloa crusgalli (L.) Beauv.

Widespread, locally frequent, almost always in colonies of moderate size, only 3 unicates recorded. Besides the typical form, f. *longiseta* (Trin.) Farw. was collected in all regions, but its occurrence was quite scanty. Naturalized. Eurasia.

Setaria glauca (L.) Beauv. (S. *lutescens* (Weigel) Hubb.)

Widespread, locally scattered, almost always in colonies of moderate or small size, only 3 unicates seen. Among the weedy Setarias this was the rarest species. Naturalized. Eurasia.

Setaria verticillata (L.) Beauv. var. *verticillata*

Quite widespread, locally scattered, almost always in colonies of different sizes, only once as a unicate. This species grew abundantly along buildings, including those which border the tracks, but it was missing from the tracks themselves. Naturalized. Eurasia. Very rare was var. *ambigua* (Guss.) Parl. *M1295*, 4 Aug. 1957, few specimens. *M 1581*, 12 Sep. 1959, 1 specimen. *M 2545*, 19 Sep. 1965, 3 specimens. In the U.S. this variety is sometimes considered to be a hybrid between *S. verticillata* and *S. viridis*, but Hegi (1908–1931, 1935–1974) considers it a species. Eurasia.

Setaria viridis (L.) Beauv.

Widespread and common everywhere. This species plus *Bromus tectorum* and *Digitaria sanguinalis* were the most common adventive plants on the railroads. Its dominance began to show quite late, at the end of June, although a few plants could occasionally be seen a month earlier. This grass thrived until frost. Naturalized. Variety **major** (Gaudin) Posp. has been collected once, *M 2717*, TRRA, Third St. and Wharf, 17 Sep. 1966, 1 specimen. Determined by R. W. Pohl. Eurasia.

Setaria faberi Herrm.

Widespread, locally frequent on the tracks as well as on the margins, open lots, and along trunk lines, sometimes the colonies were gigantic. Apparently expending, as throughout the state (Steyermark, 1963). Naturalized. Asia.

Setaria italica (L.) Beauv.

M 1032, 4 Aug. 1956, 2 specimens. *M 1068*, 8 Sep. 1956, 1 specimen. *M 2665*, 9 July 1966, a large colony. Eurasia.

Pennisetum ciliare (L.) Link

M 1704, 18 Sep. 1960, ca. 6 specimens. India and Africa.

Miscanthus sinensis Anderss.

M 822A, 1 Oct. 1955, 1 huge tuft. *M 860*, 27 Nov. 1955, 1 huge tuft; *M 1131*, 20 Oct. 1956. *M 1906*, 8 Oct. 1961, 1 huge tuft. *M 2039*, 29 Sep. 1962, 1 huge tuft. This grass began to flower very late, mostly in October. Undisturbed, this plant would be obviously persistent, but it was destroyed in all localities.

[*Miscanthus floridulus* (Lab.) Warb.]

Cited in the *Flora of Missouri*, p. 241, it is, according to T. Koyama, *M. sinensis* Anderss. It was actually originally published under the latter name as a novelty for the Missouri flora (Mühlenbach, 1957).

Erianthus ravennae (L.) Beauv.

M 500, 17 Oct. 1954, 2 huge tufts. Observed for three years, it was then destroyed by bulldozing the whole area. South Europe.

Sorghum halepense (L.) Pers.

Widespread, locally frequent, in large, often huge, dense and persistent stands. Naturalized. Eurasia.

Sorghum bicolor (L.) Moench

Quite widespread, locally scattered, mostly in colonies of modest size, but unicates not rare (15). Surely several varieties or races of the cultivated *Sorghum* were represented, but no attempts were made to more closely distinguish them. The preferred site was around the grain elevators.

Sorghum dochna (Forsk.) Snowden var. *technicum* (Koern.) Snowden
M 711, 6 Aug. 1955, few specimens (discovered by E. Anderson). *M 1105*, 29 Sep. 1956, 1 colony. Curiously enough, quantities of old brooms lay around on the ground, but they could hardly be the source of the colony.

Zea mays L.
Its occurrence was much like that of *Sorghum bicolor*, perhaps a little more frequent, and it was discovered in all regions. Its predilection for the surroundings of grain elevators was also obvious. Heaps of maize seeds on the ground there, and along many classification tracks, were striking sights.

CYPERACEAE

Carex nebraskensis Dewey
M 1199, 15 June 1957, 1 specimen. Southern and western U.S.

COMMELINACEAE

Commelina communis L.
Widespread, locally scattered, always in small colonies. Found primarily in shady places, frequently under bushes on the margins of the yards. Rarely, colonies were on the tracks in full sun, where the bulk of adventives used to thrive. Naturalized. Asia.

JUNCACEAE

Juncus gerardii Loisel.
M 2356, 14 June 1964; *M 2505*, 24 June 1965; *M 2522*, 29 Aug. 1965; *M. 2625*, 3 June 1966. In the following years it appeared constantly through 1971; when discovered, there were two dense colonies which later merged into one. A 1966 fire destroyed the surrounding vegetation far and wide, but this species persisted. Eurasia.

LILIACEAE

Allium sativum L.
Quite widespread, locally rare, observed 14 times, always in small colonies on the margins of the yards or along trunk lines, in a few places persisting for some years. Probably at least in part a garden escape.

Allium vineale L.
Widespread, locally frequent, always in colonies. Twice f. *compactum* (Thuill.) Aschers. was found (only bulblets instead of flowers in the umbels): *M 618*, 30 May 1955, rare. *M 3284*, 6 June 1970, 2 colonies. Naturalized. Eurasia.

Allium cepa L.

Onion bulbs with developed sterile sprouts are infrequently met, especially around the St. Louis Produce Market, but only twice were flowering specimens collected. First, var. *viviparum* Metz was found: *M 1165*, 30 May 1957, 2 specimens. Later var. **cepa**: *M 3100*, St. Louis Ave. Fr. Yd., 21 June 1969, 1 specimen. Determined by H. Cutler.

Hemerocallis fulva L.

It was found in all regions, but was locally quite rare. It occurred on the margins of the yards and right-of-ways. In some places it was surely persistent, possibly in most cases as an escape; however, some localities were far away from gardens. Very rare is var. *kwanso* Regel (in Regions 1, 4, 8). Eurasia.

Ornithogalum umbellatum L.

M 1144, 5 May 1957, 1 colony. *M 2331*, 10 May 1964, 1 dense tuft (UMO). Most probably a garden escape. Eurasia.

Muscari botryoides (L.) Mill.

M 3221, 25 Apr. 1970, 1 small colony near heaps of grass clippings which most probably contributed to the occurrence of this ornamental here. Europe.

Yucca filamentosa L.

M 777, 11 Sep. 1955, 1 sterile specimen. It was afterwards destroyed. According to F. G. Meyer, who determined the collection, it is near *Yucca smalliana* Fern., which has already been found in Missouri. Most likely a garden escape. Coastal Plains, Georgia to New Jersey.

Asparagus officinalis L.

Thus cultigen was quite widespread, locally scattered. It grew mostly along margins and on open lots, infrequently on tracks. Many localities were far from gardens. Sometimes flowering recurred very late in the autumn (November).

AMARYLLIDACEAE

Narcissus × biflorus Curtis (*N. poeticus* L. × *tazetta* L.)

M 3503, MP, southeast of Morganford Rd., 24 Apr. 1971, 2 large tufts. Determined by F. G. Meyer. The plant was noted already in 1970, but then considered to be an ergasiophyte. Later inquiries in the neighborhood proved that no plantings had ever been made on the siding in question. Therefore *N. biflorus* can be interpreted as belonging to the scope of this study.

IRIDACEAE

Iris germanica L.

M 530, 30 Apr. 1955, 1 specimen. *M 2323*, 2 May 1964; *M 2453C*, 8 May 1965, 1 very dense colony or a huge specimen. It disappeared, after two years, possibly having been dug out for transplantation. *M 3260*, 17 May 1970, small colony. *M 3507*, 24 Apr. 1971, 2 colonies. Surely a garden escape. *Iris* species were observed quite a few other times, but in circumstances which gave reason to believe that they were only remnants of intentional plantings (ergasiolipophytes).

ULMACEAE

Ulmus pumila L.

Widespread, locally scattered, mostly in isolated specimens on margins and open lots, rarely on the tracks. In the overwhelming majority the shrubs were low (0.5–2 m). The shrubs were, with few exceptions, sterile. Flowering and fruiting specimens were collected only thrice from older and taller shrubs. Determined by J. W. Thieret. Similar looking shrubs are frequent on St. Louis streets, especially in the alleys. Naturalized. Asia.

MORACEAE

Morus alba L.

Widespread, locally scattered, mostly in small colonies, its distribution was similar to the preceding species, except that small, crippled specimens occasionally could be found on the tracks also, even with frequent traffic. The fruits were, in the vast majority of cases, purplish violet, seldom yellowish. Naturalized. Asia.

Broussonetia papyrifera (L.) Vent.

M 3518, 9 May 1971, several tall trees as well as low shrubs in a small grove, first noticed 20 Sep. 1970. Apparently a well-established colony, but the locality could be easily wiped out by some industrial development of the terrain. Asia.

Maclura pomifera (Raf.) Schneid.

Scattered, observed in 6 regions, especially along some trunk lines where a woody vegetation accompanied the tracks. In such places some trees can reach a respectable height. Low shrubs were rarely found on tracks. Steyermark (1963) evaluated its status as introduced and naturalized in Missouri. Southwestern U.S.

CANNABINACEAE

Cannabis sativa L.

M 255, 17 Sept. 1954, 1 colony. It reappeared until 1964. At this time the colony was apparently discovered by the authorities, who regularly began to cut the plants down. The colony was completely destroyed by 1966. *M 1305*, 17 Aug. 1957, 1 small colony. Also observed MP, Spring Ave. and Vandeventer, 14 July 1963, 1 small colony, but spread over a larger area. At the three last localities, no trace could be found of *C. sativa* in the following years. Eurasia.

Humulus japonicus Sieb. & Zucc.

Widespread, locally scattered in big persistent colonies on the margins of the yards and right-of-ways, for the most part twining on different shrubs or fences, rarely, lying directly on the ground without any support, especially in Region 7, where the tops sometimes reached the rail of the track. Naturalized. Asia.

POLYGONACEAE

Rumex patientia L.

Widespread, locally frequent in large, persistent colonies. Naturalized. Eurasia.

Rumex crispus L.

Widespread, but as contrasted with the previous species, much rarer locally, developing only small colonies or occurring as a few specimens or even as unicates. Steyermark (1963) noted that this species probably occurs in every county in Missouri, while the preceding species was known from only 4 counties. This is a good example of how differently two related species can be distributed on a local and state-wide scale.

Rumex pulcher L.

M 957, 17 June 1956, 1 specimen. *M 1261*, 7 July 1957, 2 specimens. *M 1422*, 28 June 1958, 1 specimen. *M 1638*, 18 June 1960, 1 small colony. Eurasia.

Rumex obtusifolius L.

Rare, observed in 4 regions 19 times. It is likely that in several cases the same colony was repeatedly recorded in the same season. The colonies were small, in some places persisting for several years. Unicates were also observed. Eurasia.

Rumex stenophyllus Ledeb.

Possibly rare, observed in 4 regions 11 times, 6 of which were unicates, but the plant was probably much more frequent. It was recognized very late in this study. A *Rumex* collected in 1967 was sent to H. A. Wahl because it seemed to be a *R. crispus* × *R. obtusifolius* hybrid. H. A. Wahl determined it as *R. stenophyllus*; thereafter much more attention was later paid to *Rumex* species, and this species was then discovered in other localities. Steyermark (1963), also noted the resemblance of this species to a hybrid between *R. crispus* and *R. obtusifolius*. Eurasia.

Rumex dentatus L.

M 2821, North St. Louis Fr. Yd., 25 June 1967; *M & D'Arcy 3195*, 16 Oct. 1969; *M 3205*, 5 Dec. 1969, all the same plant. This annual plant persisted at the same spot for two years. In 1970 the entire area was covered with heaps of rubbish, and in 1971 a thorough bulldozing was performed, no doubt destroying the plant. Determined by C. Frankton and confirmed by K. H. Rechinger. Asia.

Rumex acetosella L.

Widespread, locally scattered, in many places persistent, always in colonies of modest size. Naturalized. Europe.

Polygonum pensylvanicum L. var. *rosaeflorum* J. B. S. Norton

M 2222, 15 Sep. 1963, 1 specimen. *M 2275*, 12 Oct. 1963, 5 specimens. *M 2275*, 12 Oct. 1963, 5 specimens. *M 2914*, 4 Nov. 1967, 1 huge specimen. *M 3475*, 7 Nov. 1970, scattered. While the typical variety is widespread in the U.S., var. *rosaeflorum* is mentioned by Fernald (1950) as a native also, but only in the East (Delaware, Maryland and Virginia). In numerous floras of states between the

Atlantic coast and Missouri it is not mentioned, so it could well be an introduced plant in St. Louis.

Polygonum lapathifolium L. var. *prostratum* Wimm.

M 2150, 27 July 1963, 1 specimen. An introduced European variety of the common American species.

Polygonum scabrum Moench

M 2766, 23 Oct. 1966, 3 specimens. *M & D'Arcy 3083*, 29 May 1969, 1 specimen. Eurasia.

Polygonum orientale L.

M 1025, 22 July 1956, also observed 9 Sep. 1956, 1 specimen. Eurasia.

Polygonum cespitosum Blume var. *longisetum* (De Bruyn) Stewart

Scattered, observed in 5 regions. Locally always in colonies which were at least somewhat persistent. First collected 1963, but later showing a definite tendency to spread. The first records from Missouri dating from 1959 were from the city —along the sidewalk of Tower Grove Ave., outside the grounds of the Missouri Botanical Garden (Steyermark, 1963). It is well known that many botanical gardens have played prominent roles in the introductions of plants. With their help a long series of plants, some of them noxious from an economical point of view, were spread, first in the immediate vicinities of the gardens, and later through whole countries. *Polygonum cespitosum* has been for years a frequent weed in the Missouri Botanical Garden, but the exact time of its appearance is not known.[11] Also unknown is the primary source of this plant. Has it advanced into the Garden from the street, or vice versa? Nowadays it appears frequently in the city. Naturalized. Asia.

Polygonum persicaria L.

Widespread, locally also often seen. Possibly it is even more frequent than records show. Several common or frequent native Polygonums look quite similar, but it would make little sense to investigate more closely every *Polygonum*. Naturalized. The white flowered f. *albiflora* Millsp. was also collected, *M 2695*, 2 Aug. 1966, 1 colony. *M 2731*, 18 Sep. 1966, 1 colony. (H. A. Wahl did a progeny test on the second collection, his no. P875, 27 July 1967.) Eurasia.

Polygonum convolvulus L.

Widespread, locally at least scattered, if not frequent. It is one of the least visible adventives and can be easily overlooked. Naturalized. Eurasia.

Polygonum cuspidatum Sieb. & Zucc.

Quite widespread, locally scattered, developing a few huge colonies on different open lots. Naturalized. In the Carrie Ave. Fr. Yd. (RI) a large colony was discovered in 1955; it flourished undisturbed through 1969. In 1970 the whole area was bulldozed to convert it into a parking lot for piggy-back trucks. Already that autumn many sprouts appeared and it even seemed that the perimeter of the colony had enlarged—the bulldozing must have conveyed the rhizomes around. By 1971 the colony was established again. Japan.

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[11] The oldest specimen in the herbarium of the Garden is from 1965.

Fagopyrum sagittatum Gilib.

Rare, observed in 5 regions 14 times, in the majority of cases only as 1–2 specimens. When colonies were observed, they were small. On tracks as well as along a seed company's warehouse.

CHENOPODIACEAE

Kochia scoparia (L.) Schrad.

Widespread, locally abundant. It was one of the most common adventives in St. Louis. In the American literature it is mostly viewed as an escape from cultivation, which seems debatable to me. Rather, Swing (1969) hit the nail on the head by calling *K. scoparia* "a very common weed" in his flora of the Chicago region, later adding, "The increase of the plant has been phenomenal." Hegi mentions that it is cultivated here and there in Middle Europe, but the description of localities (at least in Germany) seems to speak for introductions. Besides, the cultigen is mostly the variety which is not observed here or is possibly overlooked in the mass of the typical variety of this species. It is dominant in the second half of the summer. Naturalized. Eurasia.

Kochia iranica (Hausskn. & Bornm.) Litw.

M 2263, Baden Fr. Yd., 6 Oct. 1963, 1 specimen. Determined by W. A. Weber. Asia.

Chenopodium murale L.

M 1560, 2 Aug. 1959; *M 1727*, 5 Nov. 1960; *M 2306*, 26 Oct. 1963; always only a few specimens. *M 1657*, 4 July 1960, 4 specimens. *M 2308D*, 27 Oct. 1963, 1 specimen. Eurasia.

Chenopodium botrys L.

Although observed in 7 regions it must be considered rare. Most of the 24 finds were in the first three years, especially in Region 3. In later years it was very sporadic; in many years missing altogether. It was found for the last time in 1967. Only small colonies had developed and quite a few unicates (5) were observed. Eurasia.

Chenopodium ambrosioides L.

Quite widespread, locally frequent. Among the adventive Chenopodiums, it was the most frequent. It grew mostly in large, even huge, colonies, sometimes in almost pure stands, infrequently on the tracks. Naturalized. Tropical America.

Chenopodium pumilio R. Br.

M 937, 16 June 1956, 10–15 specimens, seen several times afterwards through 1958, although not on exactly the same spot. *M 2244*, 29 Sep. 1963, 2 specimens. Australia.

Chenopodium glaucum L. var. *glaucum*

M 975A, 30 June 1956, 1 specimen. *M* 2859, 5 Aug. 1967, 1 huge specimen. *M & D'Arcy 3082*, 29 May 1969, 1 specimen. Var. *salinum* (Standley) Boivin: *M* 975*B*, 30 June 1956, 1 specimen. The typical variety is native in the Old World (Eurasia), but var. *salinum* is native in the western U.S.

Chenopodium watsonii A. Nelson

M 1795, 1 July 1961, 1 specimen. Western U.S.

Chenopodium opulifolium Schrad.

M 3637, 27 July 1971, 1 specimen. Determined by J. P. M. Brenan and H. A. Wahl. This species, which must be considered a "good" one, is missing in Steyermark's *Flora of Missouri*, but in Correll & Johnston's *Manual of the Vascular Plants of Texas* is the following remark, ". . . Adv. at e. coast seaports from N.Y., N.J., Pa., Del. and Md.; also in Ill., Mo. and Tex." Several letters were of no help in discovering the primary source of the adventive occurrence of *C. opulifolium* in Missouri. Be that as it may, this species is not interpreted as a novelty to Missouri. Europe.

Atriplex rosea L.

M 1972, 16 June 1962, 1 specimen; *M 2401*, 26 July 1964; *M 2435*, 30 Aug. 1964, all the same plant. Although only parts of the plant were taken in 1964, it did not appear the following year. Eurasia.

Atriplex truncata (Torr.) Gray

M 974, 30 June 1956, 1 small colony, and 1 isolated specimen. *M 1521*, 7 June 1959; *M 2106*, 23 June 1963; *M 2210*, 15 Sep. 1963, all the same small colony. Although several specimens were left, no trace was found the following year. Western U.S.

[*Atriplex argentea* Nutt.]

Cited in the *Flora of Missouri*, p. 615, it is, according to H. A. Wahl and C. Frankton, *A. truncata* (Torr.) Gray.

Atriplex heterosperma Bunge

M 1026, 22 July 1956, 1 colony together with *A. hastata* L. The latter persisted through 1970, while no trace of *A. heterosperma* was later found. Eurasia.

Salsola kali L. var. *tenuifolia* Tausch

Observed in 6 regions, locally frequent, but by no means could it be considered a troublesome weed as has happened so frequently elsewhere. It usually grew in large, diffused, but apparently persistent, colonies with a preference for the tracks. Naturalized. Eurasia.

Salsola collina Pall.

Observed in 5 regions. The first collection was made in 1964. In the next few years it had to be considered a rarity, but since 1969 it began to appear more often. In 1971 it was quite frequent in the East Jefferson Fr. Yd. (TRRA). A rapid expansion has apparently occurred. It occurs mostly with S. *kali*. Once (in November) seen as a tumbleweed. Eurasia.

Beta vulgaris L.

M 1963, 2 June 1962, 1 specimen. The root of the plant was remarkably thin. Komarov (1934–1964) also mentions that cultivated beets after escape may degenerate and produce a small, thin root.

AMARANTHACEAE

Celosia cristata L.

M 1334, far away from any garden, 1 Sep. 1957. *M 1364*, 14 Sep. 1957, 1 specimen. *M 3688*, 6 Oct. 1971, 3 specimens. Asia.

Amaranthus palmeri S. Wats.

Rare, collected in 6 regions 23 times. However, it is possible that this plant was more frequent, but was overlooked. *Amaranthus* is one of the most prevailing genera on the railroads in the autumn. Besides the 7 adventives, 4 native species are widely spread. Moreover, numerous hybrids in different combinations make the situation even more complicated. Therefore, this species, as well as most of the other adventive ones, may not be so rare as the collections indicate. It is also possible that some other adventive species which could occur here were not recognized. *Amaranthus palmeri* appeared in small colonies, frequently as a few or unicate specimens. Especially frequently collected in Region 1. Southern U.S.

Amaranthus arenicola I. M. Johnston (*A. torreyi* (Gray) Benth.)

M 228, 5 July 1954, 1 colony. *M 745*, 4 Sep. 1955. *M 1109*, 29 Sep. 1956, 1 specimen. *M 2554*, 25 Sep. 1965, 1 specimen. Southern and western U.S.

Amaranthus hybridus L.

Widespread, locally scattered, mostly in small colonies. Naturalized. According to many writers (including Steyermark, 1963), probably native of tropical America, while Sauer (1967) considers it indigenous in North America.

Amaranthus retroflexus L.

Widespread, locally common. Naturalized. The remarks about the possible origin are the same as for the previous species.

Amaranthus powelii S. Wats.

M 736, 28 Aug. 1955, 1 specimen. *M 1435*, 4 July 1958. *M 2553*, 25 Sep. 1965, 1 specimen. *M 3587*, 26 June 1971, 1 small colony. Southern and western U.S.

Amaranthus spinosus L.

Rare, observed in 4 regions 6 times. The records for the three most frequent *Amaranthus* species in Missouri show that their distribution in St. Louis is very different from that in the state. According to Steyermark (1963), *A. hybridus* is recorded from 34 counties, *A. retroflexus* from 21, and *A. spinosus* from 28, although he does not doubt that these species must actually be more common than herbarium collections indicate. In St. Louis *A. retroflexus* is very common, but *A. spinosus* is rare, while *A. hybridus* falls in between. Possibly tropical America.

Amaranthus tricolor L.

M 3449, N&W, Era Ave. and Mimica Ave., 22 Oct. 1970, also observed 22 July 1971, 1 colony. Determined by J. D. Sauer. As in *Muscari bothryoides*, this ornamental was probably introduced with lawn clippings, dumped on the railroad. Possibly tropical Asia.

AIZOACEAE

Mollugo verticillata L.

Widespread, locally quite frequent, mostly in large but diffuse colonies. Naturalized. Tropical America.

PORTULACACEAE

Portulaca oleracea L.

Widespread, locally scattered, mostly in small, more or less diffuse, colonies or in some cases only as a few or unicate specimens. Naturalized. Asia.

Portulaca grandiflora Hook.

Rare, observed in 6 regions 30 times, in some localities repeatedly, mostly as a few or even unicate (9) specimens. In the case of one persistent colony the suspicion that it was a remnant of a previous planting (an ergasiolipophyte) could not be overcome. In other cases this plant was an ergasiophygophyte or escape, but some localities were on tracks, far away from gardens. The colors of the petals may be rose, red, or yellow (the most common). Sometimes all seen in the same colony. South America.

CARYOPHYLLACEAE

Arenaria serpyllifolia L.

Frequent, observed in 6 regions, often in large persistent colonies. Naturalized. Europe.

Stellaria media (L.) Cyrillo

Widespread, locally scattered, mostly in colonies of moderate size. Two facts are worth mentioning. First, *S. media* is much rarer on the railroads than in the city itself. Secondly, it is a vernal plant par excellence, flowering in April and May, or very seldom in June, and then disappearing completely. Towards the autumn (September) new sterile plants reappear here and there. Only once was a flowering colony detected in November. Eurasia, now cosmopolitan.

Cerastium holosteoides Fries subsp. *triviale* (Link) Möschl f. *glandulosum* (Boenn.) Möschl (*C. vulgatum* L.)

Rare, collected in 5 regions 9 times, always in small colonies. In one locality it was observed 4 years in succession. Eurasia.

Cerastium glomeratum Thuill. (*C. viscosum* L.)
M 3581, 24 June 1971, 1 specimen. Eurasia.

Cerastium semidecandrum L.
M 3520, 9 May 1971. *M 3524*, 9 May 1971. In both localities, near the MP elevator, 1 colony. This species was excluded by Steyermark (1963) from the *Flora of Missouri*. The new collections were determined by W. Möschl. Eurasia.

Cerastium pumilum Curtis
This is one of the most notable finds according to W. Möschl who determined all the *Cerastium* material. *Cerastium pumilum* has been collected 17 times in 7 regions, usually as f. *pumilum*, more rarely as f. **medium** Möschl. Apparently this species has at least in some cases been referred to the native *C. brachypodum* (Engelm.) Robins., which Möschl has also identified in a mixed colony with *C. pumilum*. *Cerastium pumilum* is considered to be a very rare adventive in the U.S. Its unexpected abundance here may perhaps be explained by previous failures in the distinction of the two species, as has been the case with *Delphinium consolida-D. ajacis* and *Torilis japonica-T. arvensis*. Europe.

Holosteum umbellatum L.
M 1132, 4 May 1957, observed through 1960. *M 2073*, 14 Apr. 1963. *M 3213*, 12 Apr. 1970. *M 3533*, 16 May 1971. In all localities colonies of different sizes. Eurasia.

Agrostemma githago L.
Quite widespread, locally scattered. The colonies were small, and it was frequently found only as a few specimens or unicates. One thing is striking; it is becoming much rarer, if recent findings are compared with those of the first years. It was recorded 16 times in 1955, 12 times in 1956, but only a single plant was observed in 1971 and none in 1970, although excursions in later years were more numerous than in the 1950s. Eurasia.

Lychnis alba Mill.
Scattered, but rare, observed in 5 regions, but like the previous species, apparently becoming rarer, having been observed 9 times in 1955, 8 times in 1956, but only 4 times in 1970. Mostly as a few or as unicate specimens, sometimes in quite large colonies. Infrequently a second flowering occurred in October. Eurasia.

Silene cucubalus Wibel
M 567, 8 May 1955, 1 specimen. *M 586*, 15 May 1955, 1 specimen. TRRA, Lesperance St. Fr. Yd., 26 June 1955, 2 specimens. MKT, Baden Fr. Yd., 22 June 1957, 2 specimens. In three localities the plant persisted for several years, in one place through 1960. A slight tendency for spreading was observed, but the plant nevertheless finally disappeared in all localities. Eurasia.

Silene cserei Baumg.
M 592, 22 May 1955, few specimens. *M 681*, 16 July 1955, 1 colony, observed

through 1963. TRRA, O'Fallon Fr. Yd., 26 May 1957, 1 specimen. MP, north of Nagel St., 29 June 1963, 1 large colony. According to Frankton & Mulligan (1974) it is a pest around railway installations in Canada. Europe.

Silene armeria L.

M 3451, N&W, Era Ave. and Mimica Ave., 22 Oct. 1970. Determined by F. Markgraf. By 20 May 1971 the colony had increased considerably in size. It was later destroyed. In the U.S. it is mostly cited as a garden escape, but Gleason (1968) described it also as "a weed in waste places almost throughout our range." Taking into consideration that the locality was on the trunk line of N&W with its numerous garden escapes, it seems reasonable to include it with the escapes. Eurasia (Fernald, 1950; but according to Komarov 1933–1964 in Asia only as an introduced plant).

Silene conoidea L.

Rare, observed in 3 regions (predominantly in one) 14 times. First one small colony was discovered; later, usually only unicates or two specimens were located. Eurasia.

Silene dichotoma Ehrh.

M 672, 9 July 1955, 1 specimen, heavily damaged by a weed killer, but still recognizable. Eurasia.

Silene gallica L.

M 2900, 28 Oct. 1967, 2 specimens. Half of a plant was left, but no trace of this species was found the next year. Eurasia.

Silene noctiflora L.

Rare, observed in 4 regions. On several occasions isolated specimens were dispersed over a whole yard, making it difficult to count localities, but in the vast majority of cases this plant appeared as unicates or two specimens. Often found on the tracks. Eurasia.

Saponaria officinalis L.

Widespread, locally frequent, usually in large colonies, but almost always only on margins or open lots. Only in exceptional cases was it found on the tracks, and then only as one or a few specimens. Naturalized. Eurasia.

Saponaria vaccaria L.

Rare, observed in 5 regions 40 times, in the majority of cases as unicates or as 2–3 specimens, very often on the tracks. Eurasia.

Dianthus armeria L.

Rare, locally observed in 4 regions 23 times, but in only 8 localities. In some places this plant was persistent for years. The longest observed time was 11 years. Partly in small colonies, or as 1–2 specimens. Europe.

RANUNCULACEAE

Ranunculus acris L.

M 923, 9 June 1956, 1 specimen (POM). Eurasia.

Ranunculus sardous Crantz

M 3280, 24 May 1970. *M 3295*, 9 June 1970, both 1 specimen. Europe.

Ranunculus arvensis L.

M 1537, 14 June 1959, 4 specimens. Although ripe achenes lay on the ground at the time of the discovery, no plants could be observed the next year. Eurasia.

Clematis dioscoreifolia Lévl. & Vaniot

M 343, 14 Aug. 1954. *M 487*, 9 Oct. 1954. *M 770*, 11 Sep. 1955. Observed in the first two localities through 1957 and 1956, respectively. Most probably a garden escape. Asia.

Delphinium ajacis L.

Widespread, locally scattered, mostly in more or less large colonies, but also as unicates, always only on margins and open lots. The colors of the flowers can be very different, even in the same colony, varying from dominantly blue to pink and white. It was persistent in many localities. Naturalized. It is most probably a garden escape. Europe.

Delphinium consolida L.

M 3106, Tyler St. Fr. Yd., 21 June 1970, 1 colony. Determined by F. Markgraf. Although several specimens were left, no trace of this conspicuous plant could be found in 1971, though the locality was very secluded and safe. Eurasia.

PAPAVERACEAE

Eschscholtzia californica Cham.

M 1788, 1 July 1961, 1 large colony, but few flowers were present (US). Pacific U.S.

Argemone albiflora Hornem.

M 669, 4 July 1955, ca. 6 specimens, observed through 1957. *M 1308*, 18 Aug. 1957, 2 specimens. Southern U.S.

CAPPARACEAE

Cleome hassleriana Chod. (*C. houtteana* Schlecht.)

M 2890, *2892*, 7 and 28 Oct. 1967, 1 specimen. Surely a garden escape, probably through dumping. Latin America.

CRUCIFERAE

Berteroa incana (L.) DC.

M 616, 30 May 1955, 3 specimens. *M 1541*, 12 July 1959, 1 specimen. BN, North St. Louis Fr. Yd., 4 July 1961, 2 specimens, not taken, but later found destroyed. Eurasia.

Lobularia maritima (L.) Desv.

M 3450, N&W, Era Ave. and Mimica Ave., 22 Oct. 1970, 1 small colony. Determined by H. Scholz and R. L. Stuckey. Probably introduced by dumped lawn clippings. Europe.

Thlaspi arvense L.

Widespread, locally frequent in colonies of different sizes on margins as well on the tracks. It was prevalent in the first half of the summer until the end of June, more or less disappeared for a period, and then around of the first of September fresh flowering colonies reappeared but as rarities. Naturalized. Eurasia.

Lepidium perfoliatum L.

Rare, observed in 4 regions 26 times, seldom in large colonies, mostly as unicates (9) or as a few specimens. It was mostly found in Region 1, especially in the North St. Louis Yard (BN). The impression was that the localities where it was found were not constant. Naturalized.

Lepidium campestre (L.) R. Br.

Quite widespread, locally rare, observed 34 times, in the majority of cases as unicates, although several large colonies were found. This plant seemed to be becoming rarer. In 1971 it was not observed at all, only twice in 1970, and seven times in 1955. Short-dated persistence in a few localities. Eurasia.

Cardaria draba (L.) Desv.

M 15, 17 Apr. 1954. *M 1169*, 30 May 1957. In both localities large colonies which persisted through 1971. *M 3519*, 9 May 1971, 1 large colony, surely until then overlooked. After flowering this species disappeared quite quickly and completely. Although *C. draba* grew luxuriantly in one locality for 18 years (and E. Anderson knew of the existence of this colony for years before), I hesitate to call it naturalized. The first two colonies especially must be considered as growing in endangered sites, where they could be easily destroyed by unforeseen activities of the railroads. Eurasia.

Cardaria pubescens (C. A. Mey.) Rollins var. *elongata* Rollins

M 62, 23 May 1954, 1 specimen. Afterwards it was frequently found through 1970, but fluctuated strongly in number. The locality was quite endangered, a narrow strip between a track and a roadway, and often sprayed with weed killers. Curiously, there was no tendency to spread from that strip. *M 906*, 2 June 1956, 1 specimen seen several times, last seen 15 May 1960 as 1 small colony. *M 1227*, 22 June 1957, 1 small colony. Asia.

Capsella bursa-pastoris (L.) Medic.

Widespread, locally common, mostly in large, more or less diffuse, colonies. Flowering began early in the spring and extended until June. Then the plant disappeared completely, but rarely reappeared with flowers and fruits late in the autumn, the earliest at the end of September. Naturalized. Eurasia.

Camelina microcarpa Andrz.

Scattered, observed in 6 regions, as a few specimens or small colonies, chiefly on the tracks. Sometimes quite a few specimens were widely spread over a whole yard. Persistence could not be ascertained. Eurasia.

Neslia paniculata (L.) Desv.

M 1153, 26 May 1957, 1 specimen. *M 1183*, 1 June 1957, 2 specimens. *M 2640*, 18 June 1966; *M 2941*, 22 June 1968, 2 specimens. *M 3121*, 4 July 1969, twice 2 specimens. The last 3 localities were along a cleanout track. Eurasia.

Raphanus raphanistrum L.

Rare, observed in 5 regions 15 times, usually as unicates, only in a very secluded locality as a small colony which persisted to the following summer. In Europe it is one of the most common weeds, and Hegi (1908–1931) described it as occurring on suitable sites "everywhere." He also mentions its introduction into North America, noting that it is a troublesome weed, especially in the East. It, therefore, seems strange that this plant has not been able to gain a firm footing in St. Louis in spite of repeated introductions. Eurasia.

Raphanus sativus L.

Rare, observed in 2 regions 10 times, mostly as unicates. Last seen, 1963.

Brassica hirta Moench (*Sinapis alba* L.)

Rare, observed in 6 regions 14 times, mostly in colonies of different sizes. It is possible that it was, at least in part, an escape from cultivation. Eurasia.

Brassica kaber (DC.) L. C. Wheeler

Widespread, locally scattered, mostly in colonies of moderate size. Flowering ceased in June, reappeared in the autumn, but, as is usual with other plants having a second late flowering, only in a few isolated specimens. Like *Raphanus raphanistrum*, with which *B. kaber* is often confused, it is in Europe a common and troublesome weed. It seems that in St. Louis *B. kaber* has adapted much more successfully. Naturalized. Eurasia.

Brassica juncea (L.) Coss.

Quite rare, but possibly sometimes overlooked in the field, different *Brassica* species often looking quite similar in the field. Recorded in 6 regions 31 times, for the most part in small colonies, but also quite a few (7) unicates were seen. Much rarer was var. *crispifolia* Bailey (*B. japonica* Hort.): *M 646*, 18 June 1955, 1 specimen. *M 1269*, 7 July 1957, 1 specimen. *M 1417*, 7 June 1958, 1 small colony. Also MP, Biddle Fr. House, 26 July and 7 Sep. 1958, 1 colony. Eurasia.

Brassica nigra (L.) Koch

Rare, observed in 3 regions 15 times. In contrast to the other species of this genus, only small numbers of plants could be found, usually as unicates, occasionally as 2 or 3 specimens. Eurasia.

Brassica rapa L.

Rare, observed in 6 regions 23 times, mostly in colonies of modest size. Only in few cases did the plants seem to be escapes from cultivation. The vast majority represented the wild form, from which the cultigens are derived. Hegi (1908–1931) uses the name *Brassica campestris* L. s. str. Eurasia.

Brassica napus L. var. *napobrassica* (L.) Peterm.

M 879, 5 May 1956, 4 specimens. MRS, River Yard, 13 May 1956, 1 specimen (not taken).

Erucastrum gallicum (Willd.) O. E. Schulz

Rare, observed in 5 regions 30 times, prevalently as unicates, rarely as 3 or more specimens. The largest number were frequently found on the tracks. Europe.

Conringia orientalis (L.) Dumort.

Rare, observed in 5 regions 17 times, mostly as unicates, but occasionally as small colonies. No persistence was ever observed. Eurasia.

Sisymbrium officinale (L.) Scop. var. *leiocarpum* DC.

Rare, observed in 4 regions 13 times, in the majority of cases as unicates. Where colonies developed, they were small. Eurasia.

Sisymbrium altissimum L.

A frequent plant, although not observed in one of the regions. It often grew in huge colonies on the tracks, as well as on open lots and margins. This is another case of differential spreading by related species after introduction in Missouri. According to Steyermark (1963), *Sisymbrium officinale* is recorded much more often than S. *altissimum* in Missouri. In St. Louis the situation is just the opposite. Naturalized. Eurasia.

Sisymbrium loeselii L.

Rare, observed in 3 regions 11 times, once as 4 specimens, in all other cases the plants occurred as unicates. Eurasia.

Arabidopsis thaliana (L.) Heynh.

Rare, observed in 3 regions 6 times, always in large dense colonies. It is a vernal plant, flowering only in April and the first week of May. Eurasia.

Descurainia sophia (L.) Webb

Scattered, observed in 6 regions, mostly in colonies of different sizes, sometimes also as unicates, on the tracks as well as on margins or open lots. Whether the colonies are persistent or whether naturalization has already been achieved could not be unequivocally determined. Eurasia.

Erysimum repandum L.

Widespread, locally scattered, mostly in colonies of different sizes. It is a vernal plant, flowering ceasing in the beginning of June. Naturalized. Eurasia.

Barbaraea vulgaris R. Br.

Rare, observed in 6 regions 27 times, mostly as unicates, sometimes as a few specimens. Grows on the tracks as well as on the margins. Eurasia.

Chorispora tenella (Pall.) DC.

Rare, observed in 5 regions 14 times. The pattern of its occurrence is unusual. In the first decade it resembled many other rare Cruciferae in its behavior. It developed only small colonies, sometimes appearing as unicates (3). Then suddenly in 1971, two huge widely separated colonies developed and flourished through the summer. On the site of the larger colony *C. tenella* had never been seen before, although the tracks concerned had been often visited in the last 5 years. Ripe fruits were abundant. Asia.

CRASSULACEAE

Sedum sarmentosum Bunge

M 2336, 17 May 1964, quite frequent (UMO). *M 2617*, 28 May 1966, 1 colony. *M 3259*, 17 May 1970, few specimens. Asia.

SAXIFRAGACEAE

Philadelphus coronarius L.

M 2330, 10 May 1964 (UMO); *M 2614*, 28 May 1966, ca. 5 shrubs, observed through 1971. Europe.

ROSACEAE

Pyrus communis L.

M 2342, 30 May 1964 (UMO), 1 low shrub, observed through 1969; *M 3155*, 6 Sep. 1969, no trace of the shrub since 1970, although the locality seemed very safe.

Pyrus malus L.

Rare, observed in 4 regions in 7 localities repeatedly. Two specimens were cut down in time. It is less probable that their introductions were caused by railroad traffic, as it is the case in the overwhelming majority of adventives. More likely, they got started from apple cores thrown by the railroadmen or passersby.

Pyrus baccata L.

M 3230, MP at Grand Blvd., 2 May 1970; *M 3402*, 2 Sep. 1970; *M 3494*, 18 Apr. 1971; *M 3564*, 19 June 1971; all from 1 small tree. Determined by K. R. Robertson. Most probably spread, as in other states, from cultivation. Asia.

Fragaria × ananassa Duchesne *F. chiloensis* (L.) Ehrh. × *F. virginiana* Duchesne

M 3621, 18 July 1971. *M 3673*, 21 Aug. 1971, 1 small sterile colony each time. In both localities the tracks where the plants occurred had not been used for a long time and in both cases some ornamental shrubs grew directly on the tracks (but were not planted there intentionally).

Potentilla argentea L.

M 3076, Lesperance St. Fr. Yd., 24 May 1969, several colonies. *M 3584*, 26 June 1971, no trace was found in 1970 on the same spot. Determined by F. Markgraf. Eurasia.

Potentilla recta L.

Quite widespread, locally frequent, mostly in colonies which were sometimes of huge size but usually were small, seldom as unicates. Occasionally some flowering recurred in late autumn. Naturalized. Eurasia.

Rubus bifrons Vest

M 3077, 25 May 1969, 1 large and dense colony observed through 1971. Europe.

Rosa multiflora Thunb.

This shrub was first discovered in 1964. In the following years it was still rare, but has been strongly spreading since 1970. Especially along the tracks of Christy Lead (MP), the number of shrubs has obviously increased. No plantings were made here. As it stands now, this rose is quite widespread in St. Louis. The flowers were white, seldom pink. In one case a colony had double flowers in both colors. It is not clear what caused this distinct expansion. The Missouri Department of Conservation fostered the planting of *R. multiflora* along rural fences and roadsides for different purposes, among others, creating wildlife cover. It seems this program has been successful, and naturalization has been achieved. Or it may be that this is a case of endoornithochorous dispersal, similar to the one described by Niemi (1969a) in Finland, where the spread of two *Rosa* species was ascribed to birds, probably crows. Japan.

Rosa rugosa Thunb.

M 2616, 28 May 1966, a dense group of shrubs. The flowers were single. The possibility that the shrubs were planted could not be excluded. They were chopped off in 1970, but some suckers began to develop the next year. Asia.

Prunus persica (L.) Batsch

Widespread, locally scattered, generally as a few or even unicate shrubs. Peaches often develop, but they are of inferior quality. One shrub had pure white flowers. Growth, of course, is possible only on the margins. The source of *P. persica* here must be the same as with the much rarer apple trees—the littered stones of eaten peaches.

Prunus armeniaca L.

M 2987, 22 Sep. 1968, 1 small sterile shrub. Shortly afterwards it was cut down. In 1970 some suckers developed, but in 1971 no trace was found.

LEGUMINOSAE

Cassia occidentalis L.

M 2423, 16 Aug. 1964, 1 specimen (UMO). Tropics.

Trifolium incarnatum L.

M 3238, 9 May 1970, 5 specimens; two were left, but no trace of them was found on 17 June 1970, although no immediate danger seemed to have existed. Europe.

Trifolium pratense L.

Widespread, locally frequent, for the greater part in colonies of moderate size. It prefers the margins and open lots. Astonishingly frequent with *Trifolium* *repens* and, to a lesser degree, with *Trifolium hybridum*. Once f. *leucochraceum* Aschers. & Prantl was found: *M 1162*, 30 May 1957, 2 specimens among abundant red ones. Naturalized. Eurasia.

Trifolium repens L.

Widespread, locally frequent but rarer than the previous species. It is also obvious that *T. repens* is rarer on the railroads than in lawns in the city. Mostly in colonies of moderate size. Naturalized. Eurasia.

Trifolium hybridum L.

Quite widespread, locally scattered, in small colonies, but unicates were also found. It prefers margins. Naturalized. Eurasia.

Trifolium campestre Schreb.

M 581, 14 May 1955, 1 small colony; also observed 13 May 1956. *M 598*, 29 May 1955, scattered. MP, Spring Ave. and Vandeventer Ave., 4 June 1956, few specimens. SL-SF, Lindenwood Fr. Yd., 9 June 1956, few specimens. Eurasia.

Trifolium dubium Sibth.

M 608, 29 May 1955, few specimens. *M 597*, 29 May 1955, few specimens. *M 1189*, 2 June 1957, frequent. *M 3258*, 17 May 1970, several large colonies; also observed 20 May 1971. The colonies grew on the margin of the railroad, which received less attention than the tracks. Europe.

Melilotus officinalis (L.) Lam.

Widespread, locally common, for the most part in large, sometimes even in huge, colonies, especially on the margins and open lots. As a rule it begins to flower 2–3 weeks earlier than the next species, *Melilotus albus*, from which it is indistinguishable in sterile stage. In autumn it also stops flowering earlier. Flowering rarely recurs late in the season into November. Naturalized. Once, f. **confertus** O. E. Schulz was found (racemes very short—under 2 cm): *M 3336*, MP elevator, 28 June; *M 3365*, 2 Aug. 1970, the same specimen from which only some branches were taken. Typical *M. officinalis* was frequent in the vicinity. Determined by F. Markgraf. Eurasia.

Melilotus albus Desr.

Widespread, locally common. The distribution is very similar to the previous species, which it frequently accompanies. The only difference is that the late-autumn flowering stragglers are not so rare as in *M. officinalis*. Naturalized. Eurasia.

Medicago sativa L.

Quite widespread, locally scattered, mostly in small colonies. This species is probably becoming rarer. In earlier years the recorded number of localities was considerably higher than in later years. Flowering rarely recurred in late autumn. Eurasia.

Medicago lupulina L.

Widespread, locally frequent, in colonies of different sizes. Besides the typical form, var. *glandulosa* Neilr. was equally frequent. The typical variety seemed, as a rule, to begin flowering earlier than var. *glandulosa.* Occasionally plants were found in which only the fruits have stalked glands, while their peduncles are covered only with hairs. Once a 4-foliate leaf was discovered on a normal specimen. Naturalized. Eurasia.

Medicago polymorpha L. var. *vulgaris* (Benth.) Shinners

M 1404, 30 May 1958, 1 small colony; *M 1507*, 24 May 1959, 1 specimen. Eurasia.

Coronilla varia L.

M 3672, 21 Aug. 1971; *M 3682*, 29 Sep. 1971, 1 small colony. Eurasia.

Lespedeza cuneata (Dumont) G. Don

M 1697, 4 Sep. 1960, 1 specimen. *M 3681*, 29 Sep. 1971, 1 small colony. Asia.

Lespedeza striata (Thunb.) H. & A.

M 2863, 26 Aug. 1967, 1 dense colony. Asia.

Lespedeza stipulacea Maxim.

Quite widespread, locally scattered in colonies of different sizes, mostly on the margins and open lots. It was especially abundant in the North St. Louis Yard where the St. Louis floodwall is crossed by a roadbed. The banks were sown at least ten years ago by a seed mixture containing 12.8% unhulled Korean *Lespedeza* seeds by weight. The plant is still thriving there. This species and *L. striata* again illustrate a profound distinction in the expansion of both species in St. Louis and Missouri. According to Steyermark (1963), both Lespedezas are quite common in Missouri, but in St. Louis, *L. striata* was found only once, while *L. stipulacea* was by no means a rarity. Naturalized. Asia.

Lespedeza bicolor Turcz.

M 3671, TRRA, Railway Exchange Agency, 21 Aug. 1971, 1 shrub. Determined by D. Isely.

Vicia sativa L. var. *nigra* L. (*V. angustifolia* Reichard)

M 1741, 27 May 1961; *M 1768*, 17 June 1961, the same specimen.

Vicia cracca L.

M 3517, Carrie Ave. Fr. Yd., 8 May 1971; *M 3571*, 20 June 1971, the same large colony. This species was excluded by Steyermark (1963) from the *Flora of Missouri.* The new collections were determined by D. Isely. Eurasia.

Vicia villosa Roth

Rare, observed in 5 regions 20 times, mostly in small colonies or as unicates (7). Only twice were the colonies quite large. Eurasia.

Vicia dasycarpa Ten.

M 95, 29 June 1954, 1 colony. *M 630B*, 5 June 1955, 1 specimen. *M 1151*, 25 May 1957, 1 specimen. *M 3264*, 17 May 1970, 1 small colony, later destroyed. Eurasia.

[*Vicia hirsuta* (L.) S. F. Gray]

This species was quoted in error in the *Flora of Missouri*, p. 940, presumably because of the scrawled label of the writer. The plant in question was V. *dasycarpa* Ten.

Lathyrus hirsutus L.

M 96, 29 May 1954, 1 colony. *M 1506*, 24 May 1959, 1 colony. Eurasia.

Lathyrus latifolius L.

Rare, observed in 5 regions 20 times, but actually the number of localities is much less, only 5. In one case the plant has spread along the N&W trunk line between Riverview Blvd. and Floy Ave. on the unusually wide marginal land of the railroad, creating many isolated colonies quite small in size. It was observed from 1963 through 1971. Flowers were mostly pink, rarely white. In two other localities plants persisted, in one case for 15 years. Nevertheless, there was no expansion. Probably a garden escape in one case, perhaps the result of dumping. Europe.

Pisum sativum L.

Variety *sativum* was found once: *M 2597*, 8 May 1966, 1 small colony. Variety *arvense* (L.) Poir. was also collected one time: *M 561*, 8 May 1955, 1 juvenile specimen without flowers. At several other occasions juvenile *Pisum* specimens were encountered, but no specific determinations were possible.

Phaseolus vulgaris L. var. *humilis* Alef.

M 1228, 22 June 1957, a large colony. *M 1714*, 1 Oct. 1960, 1 specimen. *M 2060*, 21 Oct. 1962, several colonies.

Phaseolus lunatus L. var. *lunonanus* Bailey

M 1304, 11 Aug. 1957, few specimens.

Glycine max (L.) Merr.

Widespread, locally scattered in colonies of varying sizes, including unicates. It does not seem to persist.

LINACEAE

Linum usitatissimum L.

Scattered, observed in 5 regions but in later years evidently becoming rarer. For instance, in 1971 this plant was observed only twice, while in the first year's reports fluctuated between 7 and 11 per season. Frequently found only as unicates, but when found in colonies, they were small. Almost always blue flowered, three times specimens with white corollas were found, once in the midst of a blue-colored colony.

OXALIDACEAE

Oxalis priceae Small subsp. **texana** (Small) Eiten

M 3220, N&W, Mimimica Ave. and Alpha Ave., 25 Apr. 1970, 1 small colony. Determined by D. M. Porter. This species had already been reported once from Missouri under the name *Oxalis recurva* Ell., but it was dropped by Steyermark (1963) in the *Flora of Missouri*. Southeastern U.S.

GERANIACEAE

Erodium cicutarium (L.) L'Hér.

M 1728, 13 May 1961; *M 1742*, 13 June 1961; *M 1769*, 17 June 1961, 3–4 specimens. One fruiting specimen was left, but no trace of this plant was found in following years. Eurasia.

Erodium texanum Gray

M 1762, 30 May 1961, 1 specimen (US). Southwestern U.S.

ZYGOPHYLLACEAE

Tribulus terrestris L.

Widespread, locally frequent in large, sometimes huge, colonies on the tracks as well as on the margins. It flowers from June into November. Naturalized. Eurasia.

SIMAROUBACEAE

Ailanthus altissima (Mill.) Swingle

Widespread, locally scattered. This woody species does not owe its range on the railroads primarily to railroad traffic. This tree is frequent on the streets and in the gardens of St. Louis. The light fruits develop in large numbers and are easily spread by winds. Seedlings appear on many empty lots in the city, and thanks to their rapid growth, they can reach a respectable height in autumn. Rarely may some fruits be brought in by railroad traffic. It is most frequent on margins or on open lots. In some remote corners of yards even tall and fruiting trees are present, and sometimes one may find 1 m and taller stems on rarely used tracks. Naturalized. China.

EUPHORBIACEAE

Croton texensis (Klotzsch) Muell. Arg.

M 1836, 9 Sep. 1961, 1 specimen (US). Southern and western U.S.

Croton lindheimerianus Scheele

M 1965, 2 June 1962, 1 colony. Southwestern U.S.

Ricinus communis L.

M 1268, 7 July 1957, 1 small colony, observed through 1961, it then disappeared, although the locality was very safe. TRRA, Bremen Fr. Yd., 29 Sep. 1957, 1 specimen. SL-SF, Lindenwood Fr. Yd., 16 Sep. 1962 and 10 Oct. 1963, few specimens. N&W, St. Louis Ave. Fr. Yd., 4 July 1963, 1 colony; it was later chopped down but flowered again on 3 Nov. 1963. *M 2490*, 5 July 1965, 2 specimens. Africa.

Chamaesyce prostrata (Ait.) Small (*Euphorbia prostrata* Ait.)

M 2417, 15 Aug. 1963 (UMO), observed through 1968, 1 colony. *M 2751*, 12 Oct. 1966, frequent. *M 2887*, 7 Oct. 1967, 1 colony. Tropical America.

ANACARDIACEAE

Rhus typhina L. f. *dissecta* Rehder

M 930, 9 June 1956, 1 shrub, also 27 June 1964, later destroyed. Surely a garden escape—the same ornamental was observed in the neighboring gardens. Northeastern U.S.

CELASTRACEAE

Euonymus fortunei (Turcz.) Hand.-Maz. var. **radicans** Rehder

M 3142, SL-SF at Kingshighway, 30 Aug. 1969, few specimens. Determined by K. R. Robertson. Surely a garden escape. Often cultivated as a ground cover in St. Louis, although there were no gardens in the vicinity. No trace of it was seen the next year. Asia.

BALSAMINACEAE

Impatiens balsamina L.

M 3388, 25 Aug. 1970, 1 specimen. A garden escape. Asia.

VITACEAE

Parthenocissus tricuspidata (Sieb. & Zucc.) Planch.

Rare, met in 2 regions in 6 localities. First seen 1964 in the South Ranken Fr. Yd. (TRRA), on even ground next to a track. All other localities were on the walls of buildings along the tracks. Some persistence was noted, the longest being 7 years. It is probably in most cases a garden escape from the neighboring gardens. Asia.

Vitis labruscana Bailey

M 1120, 12 Oct. 1956, observed through 1963, laying directly on the ground without any support, few specimens. An escaped cultigen.

MALVACEAE

Malva sylvestris L.

M 3689, 6 Oct. 1971; *M 3733*, 20 Nov. 1971, the same 3 specimens. Eurasia.

Malva neglecta Wallr.

M 69, 23 May 1954, 1 small colony. Eurasia.

Malva rotundifolia L. (*M. pusilla* Sm.)

Rare, observed in 3 regions 6 times, only once as a small colony but 4 times as unicates. Eurasia.

Alcea rosea L. (*Althaea rosea* (L.) Cav.)

Widespread, locally rare. Surely a garden escape—once even found with double flowers. The color of the flowers was very varied, frequently white and pink, more rarely red and yellow. Sometimes different colors were represented in the same colony. Mostly on open lots and margins; unicates were not rare. This plant has proven to be persistent in some places. Eurasia.

Anoda cristata (L.) Schlecht.

M 3062, 26 Oct. 1968, 1 specimen. Texas to Arizona.

Sida spinosa L.

Widespread, locally scattered. *Sida spinosa* was very frequently accompanied by the next species, *Abutilon theophrasti*. This association greatly facilitated the detection of this inconspicuous species. The colonies of *S. spinosa* were usually small, although unicates were also found. Tropics.

Abutilon theophrasti Medic.

Widespread, locally scattered in colonies of different sizes, several of them were huge—especially on freshly disturbed soil as after bulldozing. Unicates were quite rare. Naturalized. Eurasia.

Hibiscus syriacus L.

M 1370, 14 Sep. 1957. *M 2712*, 27 Aug. 1966, 1 low shrub each time. Surely a garden escape. Asia.

Hibiscus trionum L.

Rare, observed in 3 regions 31 times. In this species unicates were prevalent (22); in the remaining cases only small colonies were found. It was primarily found on the tracks. Eurasia.

Gossypium hirsutum L.

M 1690, 3 Sep. 1960 (US), 3 specimens. *M 2024*, 18 Aug. 1962, 1 colony. *M 2726*, 18 Sep. 1966, observed through 1968, 1 colony. MKT, Baden Fr. Yd., 2 Sep. 1967, 2 isolated specimens. Only once were flowering specimens met; therefore one is inclined to accept repeated introductions. Determined by P. A. Fryxell and D. M. Bates, although originally published by Steyermark (1963) as *G. herbaceum* L.

[*Gossypium herbaceum* L.]

Cited in the *Flora of Missouri*, p. 1652, it is *G. hirsutum* L. according to P. A. Fryxell and D. M. Bates.

STERCULIACEAE

Melochia corchorifolia L.

M 2880, Tyler St. Fr. Yd., 9 Sep. 1967, 3 specimens. Determined by L. H. Shinners. Paleotropics.

GUTTIFERAE

Hypericum perforatum L.

Rare, observed in 4 regions 8 times, in small, partly persistent colonies, but also as unicates (2). Eurasia.

TAMARICACEAE

Tamarix gallica L.

M 765, 10 Sep. 1955, 2 shrubs, later destroyed. Europe.

VIOLACEAE

Viola tricolor L.

M 875, 5 May 1956, 1 small colony. It was probably introduced by the dumping of garden refuse. Eurasia.

Viola kitaibeliana R. & S. var. *rafinesquii* (Greene) Fern.

Quite widespread, but observed only 18 times. One circumstance must be considered: It is an especially short-lived plant and disappears entirely towards the end of May. It always occurs in colonies of mostly moderate size. Opinions about the origin of this plant differ vastly. Some place its origin in southeastern Europe and northern Africa; others believe it to be a native, quite widespread in the United States. The last view is supported by Gleason (1968) among others. But even accepting the latter opinion, the question remains whether Missouri should be included in the primary range of this species. The species does seem to be expanding its range. Steyermark (1963) also noted that it is "apparently spreading (in Missouri) northward." My impression is, that V. *kitaibeliana* is not so rare now on the railroads as in previous years.

ONAGRACEAE

Oenothera kunthiana (Spach) Munz

M 1392, 20 Oct. 1957; thereafter collected several times more, the last time observed, 1962. Texas.

Gaura sinuata Nutt. ex Ser.

M 2760, 12 Oct. 1966, 1 dense colony. The plants were found on an old car cleanout track, the use of which was discontinued several years before their discovery. The place was visited regularly several times each year. As another, also conspicuous plant (*Physalis acutifolia*), was found nearby, it is difficult to assume that both plants were constantly overlooked. The wide separation of former cleanout tracks and the yard itself argues against the possibility of these being recent introductions from the yard. This is most likely a case of seed dormancy, a phenomenon well known to European adventive botanists. Texas and Oklahoma.

ARALIACEAE

Hedera helix L.

M 764, 10 Sep. 1955, 1 large colony, observed through 1964 and then destroyed. Probably a garden escape. Eurasia.

UMBELLIFERAE

Anthriscus scandicina (Weber) Mansf.

M 887, 13 May 1956; *M 960*, 17 June 1956, few specimens; *M 1150*, 25 May 1957, 1 colony. Although the locality was secluded and unthreatened, the plant did not appear in 1958 or thereafter. Eurasia.

Torilis arvensis (Huds.) Link

Widespread, locally scattered, always in colonies. It was long mistaken for *T. japonica* (Houtt.) DC. until M. E. Mathias redetermined this material. Howell (1962) had also pointed out this confusion and noted that *T. japonica* is quite rare. In spite of careful examination of each *Torilis* colony in the years 1970 and 1971, *T. japonica* could not be found. Naturalized. Eurasia.

Torilis nodosa (L.) Gaertn.

M 1403, 30 May 1958, 1 small colony. Eurasia.

Coriandrum sativum L.

M 1248, 30 June 1957, 4 specimens. *M 1975*, 17 June 1962, a large colony, also observed in 1963. Eurasia.

Conium maculatum L.

Rare, observed in 4 regions in 6 localities. In Region 4 it persisted for 8 years and created a huge colony. In other cases the colonies were small and passing; unicates were also found (2). Eurasia.

Apium graveolens L.

M 1349, 7 Sep. 1957, 2 specimens. *M 2558*, 26 Sep. 1965, 1 specimen. In both cases the plants were sterile.

Ammi majus L.

M 1539, 4 July 1959, 2 specimens. Eurasia.

Anethum graveolens L.

M 939, 16 June 1956, 1 specimen. MP, N of Biddle St., 7 July 1957, 1 specimen. N&W, St. Louis Ave. Fr. Yd., 17 June 1962, 3 specimens. *M 3105*, 21 June 1969, 1 specimen.

Pastinaca sativa L.

Quite widespread, locally frequent, often in large colonies, especially on the margins. It was probably not an escaped cultigen, but the weedy wild form. Naturalized. Europe.

Daucus carota L.

Widespread, locally scattered, mostly in small colonies. In late autumn (October–November) a second flowering could often be observed, but the plants were mostly unicates then. It was almost certainly the weedy wild form, not the escaped cultigen. Naturalized. Eurasia.

PRIMULACEAE

Anagallis arvensis L.

Rare, observed in 4 regions 7 times, once two years in a row as small colonies or as unicates (2). Only the typical form with scarlet flowers was found. Eurasia.

LOGANIACEAE

Buddleia davidii Franch.

M 3622, Union Station, not planted, 18 July 1971, 1 shrub, later destroyed. Determined by E. Norman. China.

ASCLEPIADACEAE

Asclepias subverticillata (Gray) Vail

M 2000, 28 July 1962, a large colony. The colony flourished until 1970, in spite of constant use of weed killers and at least one devastating fire which swept over the ground. Southern and western U.S.

CONVOLVULACEAE

Ipomoea coccinea L.

Rare, observed in 4 regions 18 times, in colonies of different sizes, always on margins, climbing on bushes and fences. It was subsequently found on several sites, apparently on the same spot, but skipping many years. Overlooking this quite conspicuous annual plant continuously is inconceivable; therefore, reintroductions or seed dormancy may be involved. Tropical America.

Ipomoea hederacea (L.) Jacq.

Widespread, locally scattered, always in colonies of different sizes, commonly found on the tracks and around grain elevators. Climbing was very rarely observed. Naturalized. Variety *integriuscula* Gray was found in 4 regions 11 times. Tropical America.

Ipomoea purpurea (L.) Roth

Widespread, locally scattered, in colonies of different sizes on margins and open lots. Mostly climbing, but procumbent specimens were occasionally seen. The prevalent colors of the corollas were purple and red, but white corollas were also observed. *Ipomoea purpurea* is probably at least partly a garden escape, as it is common in city gardens. That is less conceivable in the case of the previous species, *I. hederacea*, which seems much less suitable as an ornamental, although Bailey (1960) cited it in his *Manual of Cultivated Plants*. Very rare was var. *diversifolia* (Lindl.) O'Donell: *M 811*, 25 Sep. 1955, a small climbing colony, observed through 1971. Tropical America.

Ipomoea cairica (L.) House

M 1711, 1 Oct. 1960, few specimens (US). Africa.

Jacquemontia tamnifolia (L.) Griseb.

M 3188, Lesperance St. Fr. Yd., (MP) 5 Oct. 1969, 1 specimen. *M 3408*, Carr. St. Fr. Yd., 6 Sep. 1970, 2 specimens. Determined by K. R. Robertson. Southeastern U.S.

Convolvulus pellitus Ledeb. f. *anestius* Fern.

M 601, 29 May 1955, 1 colony. *M 2463*, 22 May 1965, 1 small colony. Probably a garden escape. China.

Convolvulus arvensis L.

Widespread, locally common, mostly in large colonies. It could be found everywhere. Naturalized. Eurasia.

Cuscuta indecora Choisy var. *neuropetala* (Engelm.) Hitchc.

M 973, 30 June 1956, 1 large colony; *M 1462*, 9 Aug. 1958, several colonies. The principal range of this species seems to be in the southern United States, but it also has several extensions to the northern states, among others, Illinois and Minnesota. Therefore the plant could be native in Missouri also, but the locality was directly on the tracks, where other adventives were found. The hosts were the common *Convolvulus arvensis* and a completely dried crucifier, probably *Erysimum repandum.*

BORAGINACEAE

Heliotropium indicum L.

M 2171, 17 Aug. 1963, 1 colony. Asia.

Echium vulgare L.

M 643, 18 June 1955, 1 specimen. Eurasia.

Lithospermum arvense L.

Widespread, locally scattered, mostly in small colonies. Being a vernal plant, it disappears in the first half of June. This was the first adventive ever observed in this study, 17 April 1954. Eurasia.

Amsinckia lycopsoides Lehm.

M 893, 30 May 1956, 1 colony. *M 959*, 17 June 1956. *M 1772*, 17 June 1961 (US). *M 2083*, 30 May 1963, in the last 3 localities, 1 specimen each time. Western U.S.

Amsinckia hispida (R. & P.) Johnston (*A. micrantha* Suksd.; *A. retrorsa* Suksd.)

M 2363, 20 June 1964, 1 specimen. *M 2368*, 21 June 1964, 5 specimens. Western U.S.

Amsinckia tesselata Gray

M 44, 23 May 1954, 1 small colony. *M 2790*, 27 May 1967, 1 specimen; only parts were taken, but there was no trace of the plant the next year. Western U.S.

Lappula echinata Gilib.

Rare, observed in 4 regions 21 times, especially common in Region 1. Prevalently found as unicates (17) but in other cases, where there were several specimens, they were spread widely over the yards, so that it was impossible to speak of colonies. This distribution pattern was quite striking. The nutlets, four in each flower, are provided with prickles and one might expect several nutlets to be transferred simultaneously. Apparently this does not happen. Eurasia.

Lappula redowskii (Hornem.) Greene var. **redowskii**

M 2787, 27 May 1967; *M 3530*, 16 May 1971, 1 specimen each time. Determined by J. L. Gentry, Jr. Western U.S.

VERBENACEAE

Verbena brasiliensis Vell.

M 3439, 20 Sep. 1970, 3 specimens; *M 3466*, 29 Oct. 1970; although one specimen was left, no trace of this plant was found the next year. Determined by H. N. Moldenke. South America.

Verbena halei Small

M 1256, 4 July 1957, 1 specimen. *M 1423*, 28 June 1958, 2 specimens; *M 1607*, 22 May 1960, 4 specimens, only two were taken, but no trace of the plant was found the next year. All specimens in the Moldenke Herbarium. Southern U.S.

LABIATAE

Nepeta cataria L.

Rare, observed in 4 regions 24 times, in the majority of cases as unicates (15) or as small colonies. One colony was observed in two succeeding years, but no persistence, let alone naturalization, had been achieved. Eurasia.

Glechoma hederacea L. var. *micrantha* Moricand

Rare, observed in 4 regions in 7 localities, in two constantly over 17 and 12 years. It always grew in colonies, never on the tracks. The long-persisting colonies grow in deep shade. Eurasia.

Dracocephalum parviflorum Nutt.

Rare, observed in 2 regions 11 times, typically as unicates, rarely as 2 or 3 specimens. It is widely spread in the U.S., especially in the northern states, and Gleason (1968) also cites Missouri. On the other hand, Steyermark (1963) explicitly mentions it as introduced here.

Leonurus cardiaca L.

Quite widespread, locally scattered, always in colonies of different sizes. It was persistent in quite a few localities—in one even for 17 years. In some localities there seems to be some expansion of the sites. Naturalized. Eurasia.

Galeopsis tetrahit L.

M 934, 16 June 1956. *M 978*, 30 June 1956. *M 992*, 1 July 1956. In all localities one specimen at a time. Eurasia (Fernald, 1950) or Europe (Komarov, 1933–1964).

Lamium amplexicaule L.

Widespread, locally common, always in colonies of different sizes on the margins and open lots, as well as on the tracks. Besides the typical form with well-developed corollas, f. *clandestinum* (Reichenb.) G. Beck with cleistogamous flowers was equally frequent. Flowering started in March and continued into June, when the plant disappeared. In October, very rarely in the last half of September, flowering recurred on freshly grown specimens, but then they were rare and almost always f. *clandestinum*. Naturalized. Eurasia.

Lamium purpureum L.

Rare, observed in 4 regions in 12 localities, in colonies of very varied sizes. The impression is that this species is, to some extent, failing here, though it must be added that 5 localities were discovered in the last two years of this study. In contrast to the previous species, no late autumn flowering was ever noticed. Eurasia.

Mentha spicata L.

M 3652, 1 Aug. 1971, 1 colony. Europe.

Mentha × *gentilis* L. (*M. arvensis* L. × *M. spicata* L.)

M 301, 8 Aug. 1954, observed through 1971. *M 813*, 25 Sep. 1955, observed through 1971. *M 1103*, 22 Sep. 1956, observed through 1964. *M 3363*, 2 Aug. 1970. *M 3446*, 18 Oct. 1971. In all places, the plants grew in colonies, and showed remarkable persistence. R. M. Harley (pers. comm.), who determined the *Mentha* material, stated that these "plants are close to the form of the hybrid, which has been known as *M. cardiaca* (S. F. Gray) Baker, a widely cultivated plant." Europe.

Perilla frutescens (L.) Britt.

M 1088, 15 Sep. 1956, 1 specimen. *M 2034*, 16 Sep. 1962, 1 colony, observed through 1964. *M 3199*, 21 Oct. 1969, 1 large colony, also observed 25 Oct. 1970, 3 specimens. *M 3480*, 7 Nov. 1970, 1 specimen. This is probably, at least in part, a garden escape. Asia.

Ocimum basilicum L.

M 1333, 1 Sep. 1957, 1 specimen. It is most probably a garden escape. Asia.

SOLANACEAE

Solanum tuberosum L.

Rare, observed in 3 regions 20 times, although only sprouting tubers were observed. Flowering was never observed, although very immature flower buds were seen twice. It was especially frequent along the unloading platforms of the St. Louis Produce Market.

Solanum sarachoides Sendtner

M 1436, 4 July 1958, 2 specimens. South America.

[*Solanum villosum* Mill.]

Cited in the *Flora of Missouri*, p. 1312, it is, according to W. G. D'Arcy, in one case *Solanum sarachoides*; in the other the specimens are too juvenile for certain determination.

Solanum rostratum Dunal

Scattered, observed in 6 regions, mostly in colonies of modest size, but also as unicates. It was often found on the tracks. Although the plant has been labeled an aggressive weed, it has not been able to gain a firm footing in St. Louis's railroads. On the contrary, it has become decidedly rarer during the years of this study. Western U.S.

Lycopersicum esculentum Mill.

Quite widespread, locally scattered, mostly in colonies of different sizes, but also as unicates. The development of the fruits was almost always retarded—only once were reddish tomatoes of considerable size. It was probably mostly spread by the movement of produce. Since it was spread quite evenly over all regions, it was quite likely that the throwing away of good remains was also important in its dissemination, and it probably also becomes attached to shoes and is subsequently spread about. The seeds of tomato are very enduring according to my experience. Tomato can even be found growing on sludge after sewage treatment, including chlorination. Direct escape from gardens is probably less important.

Physalis viscosa L. var. *cinerascens* (Dunal) Waterfall

M 2486, 5 July 1965, 1 specimen. Southern and southwestern U.S.

Physalis acutifolia (Miers) Sandw. (*P. wrightii* Gray)

M 2759, 12 Oct. 1966, 1 specimen. Southern and southwestern U.S.

Lycium halimifolium Mill.

Widespread, locally scattered, always in large, dense thickets, on margins and open lots. Observed in several locations through all years. Naturalized. Europe.

Datura stramonium L.

Quite widespread, locally scattered, mostly in colonies of different sizes, although unicates were also found. Observed in several localities for many years. Naturalized. Its origin is sometimes said to be Asia, sometimes South America. Very rare was var. *tatula* (L.) Torr.: *M* 322, 8 Aug. 1954, 1 specimen. Often specimens were seen in which the stems and corollas had some tint of lavender or violet which is intermediate between true var. *stramonium* and *tatula*. Curiously, green stems and pure white corollas typical of var. *stramonium* were mostly seen in low specimens. Eurasia.

Datura innoxia Mill.

Rare, observed in 4 regions in 8 localities, in small colonies or as unicates (3). In two localities repeatedly seen for 2 and 3 years. Tropical America.

Petunia axillaris (Lam.) B. S. P.

M & Anderson 707, 6 Aug. 1955, 1 specimen. A garden escape, although there were no gardens in the vicinity. South America.

Petunia × *atkinsiana* D. Don (*P. violacea* Lindl. × *P. axillaris* (Lam.) B. S. P.) Rare, observed in 5 regions 15 times, mostly in small colonies, only once was a very large colony discovered on a big open lot, which had previously been bulldozed for industrial development. For this ergasiophyte Steyermark (1963), as well other leading floras, use the name of one of the parents—*Petunia violacea* Lindl. E. Anderson emphatically opposed this practice because of the hybrid status of this taxon. F. G. Meyer, who determined one collection, called this plant *Petunia* × *atkinsiana*. South America.

SCROPHULARIACEAE

Verbascum thapsus L.
Widespread, locally frequent, in colonies of very different sizes, some of them huge, on margins and open lots, as well as on the tracks, but in the last case the tall plant was stunted by passing freight trains. In a few cases unicates were seen. Naturalized. Eurasia.

Verbascum blattaria L.
Quite widespread, locally scattered, in colonies of modest size or seldom as unicates. Both corolla color forms were encountered—f. *blattaria* (yellow) and f. *erubescens* Brugger (white)—occasionally in the same colony. As elsewhere, f. *erubescens* was more common. Naturalized, although no persistence was noted. Eurasia.

Kickxia elatine (L.) Dumort.
Rare, observed in 5 regions in 8 localities. It was a true ephemerophyte in 6 localities, but one colony, discovered in 1955, grew through 1970, after which it was destroyed by lubricants and paint. Another colony persisted for 5 years. Europe.

Linaria vulgaris Hill
Rare, observed in 4 regions in 6 localities, with one exception in colonies of different sizes. Remarkable was the tendency to persist for prolonged periods of time. One colony, under observation for 9 years, still flourished, but two other colonies which persisted for 8 years vanished without obvious causes. This is a case which shows why one should be exceedingly reserved in predicting naturalization for a species. Europe.

Antirrhinum majus L.
M 1050, 25 Aug. 1956, 1 colony. The plant must have been a garden escape through dumping of garden refuse. The color of the corollas in single specimens was widely different, including greenish yellow, which never appears in wild plants. Europe.

Chaenorrhinum minus (L.) Lange
Observed in 4 regions. It was first discovered in 1955, and 4 more localities were discovered through 1969. In all these only 1–5 specimens were observed. Suddenly since 1970, 5 localities were discovered with the plants growing in large,

sometimes even huge, colonies. What evoked this "explosion" is not known. *Chaenorrhinum minus* was a very rare plant through 1969, but must now be designated as scattered or frequent. Europe.

Paulownia tomentosa (Thunb.) Steud.

M 2347, 31 May 1964, 6 specimens. These shrubs, growing close to the right-of-way of the railroad produced suckers that managed to reach the nearest, rarely used track and began to grow between the rails. These suckers were later destroyed, but the shrubs themselves, although several times heavily damaged, survived through 1971. Asia.

Veronica arvensis L.

Widespread, locally common, often in huge dense colonies on open lots and margins, as well as on the tracks. It is a typical vernal plant and ceased to flower in the first half of June. Only once were fresh, but sterile, specimens found in November. Naturalized. Eurasia.

Veronica polita Fries

M 3224, 25 Apr. 1970, 1 small colony. Eurasia.

BIGNONIACEAE

Catalpa bignonioides Walt.

M 1623, 4 June 1960, 3 flowering trees. It is very likely that *C. bignonioides* is not at all so rare as the sole collection would indicate. Catalpas are not at all rare on the railroads, especially on some unused tracks. Some could not be determined with certainty and others were probably the native *C. speciosa* Warder. They are usually very low shrubs, sometimes even seedlings. Southeastern U.S. (from Georgia to Mississippi).

PEDALIACEAE

Sesamum orientale L. (*S. indicum* L.)

M 3148, 1 Sep.; *M 3181*, 4 Oct. 1969, 4 specimens from the same colony. Africa.

PLANTAGINACEAE

Plantago major L.

M 743, 4 Sep. 1955, 1 small colony. *M 2544*, 19 Sep. 1965, 1 specimen. *M 2650*, 25 June 1966, few specimens. *M 2954*, 4 July 1968, 1 small colony. *M 3658*, 7 Aug. 1971, 1 colony. It was possibly often overlooked since the very similar looking native *P. rugelii* Dcne. frequently accompanied this species. However, according to Steyermark (1963), *P. major* is rare elsewhere in Missouri also. Eurasia.

Plantago lanceolata L.

Widespread, locally frequent. It was an especially gregarious species—never was a unicate located. The size of colonies was quite variable, mostly of moderate size. Occasionally a monstrosity with compound and lobate spikes was encountered. Naturalized. Eurasia.

Plantago wrightiana Dcne.

M 1779, 18 June 1961, 1 colony (US), observed through 1964 and then destroyed. *M 2376*, 28 June 1964 (UMO), 3 specimens. *M 2646*, 19 June 1966, 1 specimen (DAO). Texas and Arizona.

CAPRIFOLIACEAE

Lonicera xylosteum L.

M 3528, 15 May 1971; *M 3568*, 19 June 1971; *M 3605*, 10 July 1971; *M 3675*, 22 Sep. 1971, all from the same shrub. Probably a garden escape. Eurasia.

Lonicera morrowii Gray

M 2124, 30 June 1963, 1 shrub, observed through 1971. *M 3561*, 6 June 1971, 1 shrub. Probably a garden escape. Eurasia.

Lonicera japonica Thunb.

Quite widespread, locally scattered, observed in 12 localities, some persistent for a long time. *Lonicera japonica* grew on margins, especially in proximity to other shrubs on which it begins to twine. Another preferred site was on border fences. Once a colony was discovered growing without any support. In St. Louis it can hardly be described as a pernicious weed as was done by Fernald (1950). The colonies were modest in size and, where persistent, showed no tendency to expand. Naturalized. Asia.

DIPSACACEAE

Dipsacus sylvestris Huds.

M 347, 14 Aug. 1954, a huge colony, persisting through 1971, but not spreading very much. *M 2012*, 4 Aug. 1962, but first observed 8 May 1955, 1 small colony, observed through 1970 and then destroyed, also very inactive in spreading. Naturalized. Eurasia.

CUCURBITACEAE

Cucurbita pepo L. var. *ovifera* (L.) Alef.

Rare, observed in 2 regions 6 times. Widely isolated specimens were repeatedly observed in the same yard; it seemed improper to speak in such cases of only one locality. The plants grew mostly as unicates, sometimes reaching huge sizes. In 4 localities undeniable dumping had taken place.

Cucumis melo L.

Rare, observed in 3 regions 9 times, as unicates (5) or as small colonies, with some preference for tracks (6). For the most part no obvious signs of dumping (in contrast with the previous species) were obvious. Several times noticeable fruits were beginning to develop.

Cucumis sativus L.
M 1847, 9 Sep. 1961, 1 specimen.

Citrullus lanatus (Thunb.) Mansf. (*C. vulgaris* Schrad.)
This was the most common escape in the gourd family. Quite widespread, locally rare, observed 35 times, mostly in small colonies, but also as unicates (16). No special site preference was obvious, nor did its appearance appear to be connected with dumping.

Lagenaria siceraria (Molina) Standley (*L. vulgaris* Ser.)
M 1055, 2 Sep. 1956. *M 1476*, 31 Aug. 1958. *M 3630*, 22 July 1971; *M 3717*, 1 Nov. 1971, everywhere as small colonies.

CAMPANULACEAE

Campanula rapunculoides L.
M 3322, 23 June 1970; *M 3691*, 6 Oct. 1971; *M 3718*, 1 Nov. 1971, all one colony. It is sometimes considered a garden escape by American botanists, and it was found in a region where garden escapes were especially frequent. However, many other *Campanula* species are much showier and more desirable as ornamentals. Furthermore, Hegi (1908–1931) considered it only a weed and a ruderal plant in Europe. Most likely that is the case here also. Europe.

COMPOSITAE

Eupatorium capillifolium (Lam.) Small
Rare, observed in 2 regions in 6 localities, mostly as unicates, only once as 2 specimens. It flowered very late in October. Chiefly in the Atlantic and Gulf Coast U.S. (from New Jersey to Texas).

Grindelia squarrosa (Pursh) Dunal var. *serrulata* (Rydb.) Steyerm.
M & Anderson 712, 6 Aug. 1955, few specimens. Western U.S.

Gutierrezia texana (DC.) T. & G.
M 1715, 1 Oct. 1960, 1 specimen. Southwestern U.S.

Franseria discolor Nutt.
M 439, 19 Aug. 1954, 1 large colony, which persisted for many years, in spite of continual spraying with weed killers. Last observed in 1968. *M 738*, 28 Aug. 1955, 2 specimens. Western U.S. and Illinois. Therefore, the possibility that *Franseria discolor* is in reality a native plant cannot be ignored, but since it grew with many typical adventives, it is more likely that it belongs to the latter category.

Ratibida tagetes (James) Barnhart
M 1865, 16 Sep. 1961, 1 huge specimen (US); *M 2419*, 15 Aug. 1964, 1 specimen (UMO). Western and southwestern U.S.

Verbesina encelioides (Cav.) B. & H. var. *exauriculata* Robins. & Greenm.
Observed in 4 regions. It was very irregularly distributed, ranging from common

in some areas to rare in others. It grew as unicates or in huge colonies that persisted for many years. Profuse flowering started in mid-May and continued without intermission into November. Naturalized. Western and southern U.S.

[*Thelesperma ambiguum* Gray]

Cited in the *Flora of Missouri*, p. 1653, it is actually *T. trifidum* (Poir.) Britt. according to a determination at the Smithsonian. This latter species is native to Missouri.

Coreopsis cardaminefolia (DC.) T. & G.

M 1829, 20 Aug. 1961, 1 specimen (US). Western and southern U.S.

Bidens coronata (L.) Britt.

M 3706, Luther Fr. Yd., 17 Oct. 1971, 3 specimens. Determined by R. P. Wunderlin. The plants grew on the edge of a newly established parking lot, bordering on a preexisting wet depression where some plants of wet habitats grew. *Bidens coronata* is a plant of wet habitats, a group of plants which seldom produce adventives, so it is possibly a native element, until now overlooked. Steyermark (1963) grouped it with those species that he thought most likely to extend into Missouri from Illinois. According to Jones (1955), it grows on moist ground throughout Illinois, including St. Clair County which is just opposite the city of St. Louis. Widely spread in the U.S., mostly in the eastern and northern states.

Bidens pilosa L. var. **radiata** Schz.-Bip.

M 3046, Baden Fr. Yd., 24 Oct. 1968, 1 large specimen. Determined by R. D. Weedon. Although only a few branches were taken, it did not appear the next year. Tropical America.

Cosmos bipinnatus Cav.

M 1471, 30 Aug. 1958, 1 specimen. A garden escape. Mexico.

Cosmos parviflorus (Jacq.) Pers.

M 2285, Carrie Ave. Fr. Yd., 20 Oct. 1963, 1 specimen. Determined by T. E. Melchert. Western and southern U.S.

Galinsoga ciliata (Raf.) Blake

M 1617, 30 May 1960, 1 specimen. *M 1958*, 30 May 1962, 1 specimen; *M 2812*, 18 June 1967. RI, Carrie Ave. Fr. Yd., 7 Oct. 1967, 4 specimens. *M 2556*, 26 Sep. 1965, observed through 1968, always in colonies. Tropical America.

Gaillardia pulchella Foug.

M 1003, 8 July 1956, 1 specimen. *M 3390*, 25 Aug. 1970, 1 specimen. Probably a garden escape. The first one was far removed from all gardens. Western and southern U.S.

Tagetes patula L.

M 1461, 27 July 1958, 2 specimens. *M 2507*, 7 Aug. 1965, 1 specimen. Probably a garden escape. Mexico.

Achillea millefolium L.
Widespread, locally scattered, mostly in colonies of modest size, especially on margins. Naturalized. Eurasia.

Anthemis cotula L.
Rare, observed in 5 regions 31 times, occasionally quite a few isolated specimens were spread over a whole yard; however, normally it appeared in colonies of modest size, or seldom as unicates (3). A predilection for tracks was evident. Europe.

Anthemis arvensis L.
Rare, observed in 3 regions 8 times, usually in small colonies, thrice unicates, once in a mixture with *Anthemis cotula*. Eurasia.

Matricaria chamomilla L.
Rare, observed in 4 regions 20 times, mostly in small colonies, sometimes as unicates (6). Eurasia.

Matricaria matricarioides (Less.) Porter
Rare, observed in 3 regions 10 times, mostly small colonies, twice as unicates. Only once did a large colony develop, which persisted for 3 years. *Matricaria matricarioides*, which originates in northeastern Asia or in northwestern America, or according to others, in both, is a real puzzle to me. The reports about the phenomenal spread of this species in the last 100 years are innumerable. As Hegi (1908–1931) emphasized, it spread out especially along the railroads. In 1931 it was present in almost every railroad station in Germany. Moreover, Jones & Fuller (1955) reported that this adventive weed was apparently so well established in St. Louis by 1825 that G. Engelmann mistook it for a native plant. In Missouri it is scattered throughout the state and reported from 20 countries (Steyermark, 1963). It was not known in Chicago prior to 1930, but it has increased tremendously in the entire Chicago region in recent years (Swink, 1969). Therefore its rarity on St. Louis railroads is astonishing.

Chrysanthemum leucanthemum L.
Quite widespread, locally rare, observed 40 times, in half of them as unicates, in the other, almost always as small colonies. Fernald (1950) described it as a pernicious but beautiful weed. Bailey (1960) noted that it is probably not regularly cultivated, although it perhaps appears in gardens. In St. Louis it is tolerated in many gardens and spared during grass mowing. It appeared primarily along the N&W trunk line (Region 7), where an abundance of garden escapes was observed during the survey due to widespread dumping of garden refuse. Elsewhere, its introduction as a weed was more probable. Naturalized. Eurasia.

Tanacetum vulgare L.
M 3038, 21 Oct. 1968, 1 miserable specimen. Eurasia.

Artemisia biennis Willd.

M 932, 16 June 1956; *M 1012*, 14 July 1956; *M 1258*, 7 July 1957, 1–4 specimens. *M 1414*, 7 June 1958, ca. 12 specimens. TRRA, Harlem Fr. Yd., 28 June 1958, 1 specimen and 13 June 1959, 1 colony. Supposedly northwestern U.S.

Artemisia vulgaris L.

Rare, observed in 3 regions in 6 localities, always in colonies of different sizes, mostly repeatedly, with the longest observation time 4 years. It was first found in 1956 and Steyermark (1963) in his *Flora of Missouri* subdivided it, probably unnecessarily since all plants came from a very small area, into three varieties—var. *vulgaris*, var. *glabra* Ledeb., and var. *latiloba* Ledeb.

Artemisia absinthium L.

M 1656, 25 June 1960. *M 2777*, 9 Apr. 1967, in each case a single rosette which was later destroyed. *M 1695*, 3 Sep. 1960, one strong rosette, growing on a track with quite heavy traffic. It was later (1962 or early 1963) transplanted to someone's garden. Eurasia.

Senecio vulgaris L.

M 1428, 28 June 1958. *M 1645*, 19 June 1960. *M 2092*, 30 May 1963, all as unicates. Eurasia.

Senecio ampullaceus Hook.

M 1735, 21 May 1961, 6 specimens (US). Two were left, but no trace of the plant was found the next year. Texas.

Arctium minus (Hill) Bernh.

Quite widespread, locally scattered, in colonies of different sizes, almost always on margins and open lots. In several localities it was observed for many years, but at others it disappeared. Naturalized. Europe.

Carduus nutans L.

Quite widespread, locally scattered. There is no doubt that it has managed to expand its range in St. Louis greatly. From 1954 to 1956 only 3 occurrences as unicates or as a few specimens were recorded. In contrast, in 1971, 24 colonies were counted, many of them huge and having persisted for many years. It also appears now in the city on vacant lots. Naturalized. Eurasia.

Cirsium vulgare (Savi) Ten. (*C. lanceolatum* (L.) Hill)

Quite widespread, locally scattered, in small colonies or as unicates, margins and open lots are preferred. It may be confused with some of the native species and may sometimes have been misidentified. Naturalized. Eurasia.

Cirsium arvense (L.) Scop.

Although Fernald (1950) has called it a ubiquitous weed of cultivation and waste ground, *C. arvense* is a rarity here. It was observed in 4 regions 31 times, mostly in colonies of moderate size and was frequently encountered repeatedly. Some colonies were found to be sterile, even in the autumn. Nevertheless, it seems that naturalization is achieved. The longest observation time of a colony was 8 years. Eurasia.

Cirsium texanum Buckley

All in TRRA, South Ranken Yd., *M 2478*, *M 2480*, 27 June 1965, 2 isolated specimens; *M 2663*, 4 July 1966, 1 specimen. Determined by L. H. Shinners and G. B. Ownbey. Texas and Oklahoma.

Centaurea solstitialis L.

M 970, 24 June 1956. *M 1425*, 28 June 1958. *M 1877*, 30 Sep. 1961, in all cases 1 specimen. Eurasia.

Centaurea diffusa Lam.

M 1641, 19 June 1960, 2 specimens. The plant grew through 1970. The fluctuation in the number of plants was remarkable. In some years only 2 specimens could be counted; in others a flourishing colony developed. The plants grew on the track itself or in the vicinity of or on the large heaps of rubbish accumulated from the cleaning of cars. From time to time the rubbish was removed along with all the vegetation. In 1971, after 11 years of observation, no trace of *C. diffusa* was found. Until then one would have thought naturalization to be a fact. This is another classical case that shows how easily a railroad plant, persisting without difficulty on the same spot for more than a decade, can be wiped out. Eurasia.

Centaurea cyanus L.

Widespread, locally scattered, mostly in small colonies, rarely as unicates or in very large colonies. It is usually regarded as an escaped ornamental in the United States, but not as an introduced weed. This concept seems to fit the circumstances in St. Louis well. The colors of the flowers varied quite considerably from blue, which was the most prevalent, to whitish, pale pink, or purple. Often all these colors were represented in the same colony. These colors are, according to Hegi (1908–1931), frequently seen in the cultivated forms, but are rare or absent in wild forms. Naturalized. Eurasia.

Centaurea nigra L.

M 941, 16 June 1956; *M 1014*, 14 July 1956, 1 specimen each time; *M 1262*, 7 July 1957, a colony had formed by this time. The whole area was then cleared for a parking lot. G. Wagenitz has indicated that because of hybridization in the section to which these specimens belong determination was very difficult, and the plants are probably hybrids. The plants deviate from typical *C. nigra* especially in their phyllaries. The determinations are very uncertain. A similar situation has been found in Vienna by Rechinger (1950).

Centaurea stoebe L. subsp. **stoebe** (*C. rhenana* Bor.)

M 3613, Bremen Fr. Yd., 17 July 1971, 1 small colony. Determined by G. Wagenitz. Europe.

Centaurea maculosa Lam.

M 1816, 19 Aug. 1961 (US); *M 1852*, 10 Sep. 1961 (US), the same specimen. Although on both dates only branches were taken, no trace of this plant was seen the next year. Europe.

Centaurea diluta Ait.

MP, Lesperance St. Fr. Yd., *M 3299*, 14 June 1970; *M 3348*, 25 July 1970, 1 colony, ca. 12 specimens. Determined by G. Wagenitz. *Centaurea diluta* has previously only been reported from California in the United States. An inquiry in the seed firm next to the locality indicated that its warehouse received all its seed material from their headquarters in California in previous years, and this may pinpoint the source of this adventive. Mediterranean region.

Cichorium intybus L.

Widespread, locally frequent, in colonies of different sizes, sometimes huge, seldom as unicates. Once f. *albus* Neum. was recorded: *M 3403*, 2 Sep. 1970, amidst a colony of typical f. *intybus* with blue flowers. Naturalized. Eurasia.

Hypochaeris radicata L.

M 890, 30 May 1956, 1 specimen. Eurasia.

Picris hieracioides L.

M3377, MRS, Potomac St. and President St., 23 Aug. 1970, 4 specimens; *M 3650*, 1 Aug. 1971, 1 colony. Determined by R. P. Wunderlin. Eurasia.

Picris echioides L.

M 3300, Lesperance St. Fr. Yd. (MP), 14 June 1970, 5 specimens. Determined by D. M. Porter. Two specimens were left but no trace was found the next year, although the locality could be considered safe. Eurasia.

Tragopogon pratensis L.

M 1285, 21 July 1957, 1 colony. Europe.

Tragopogon dubius Scop. (*T. major* Jacq.)

Widespread, locally frequent in dispersed colonies of modest size, rarely as unicates. Flowering began in May and continued through July; afterwards some flowering heads could be seen on specimens which had already fruited. Occasionally in late autumn, through November, new flowering plants reappear. Naturalized. Eurasia.

Taraxacum officinale Weber

Widespread, locally frequent, for the most part in more or less dispersed colonies of different sizes. Flowering began in April and continued into November, but the amount fluctuated. *Taraxacum officinale* is much more frequent in the city then on the railroad. No doubt many dozens of the hundreds of the microspecies distinguished in Europe, especially by the Swedes, were represented, but no attempts were made to delve into this problem. It is odd, however, that *Taraxacum erythrospermum* Andrz. was never found, although many hundreds of *Taraxacum* plants were closely examined in the field. Naturalized. Eurasia.

Sonchus arvensis L. var. *glabrescens* Guenth.

Rare, observed in 5 regions in 13 localities, in small colonies and as unicates (2). In some places the plants persisted for some years, the longest time being 8 years; nevertheless they then disappeared without any obvious reason. Neither was there expansion of the sites. The passivity of S. *arvensis* on the railroad is remarkable, as in Europe it belongs to the most feared weeds (Hegi, 1908–1931). Fernald (1950) also mentions it in the U.S. as locally abundant. In 1971 the plant was seen only twice. Naturalized. Eurasia.

Sonchus oleraceus L.

Widespread, locally scattered. While the previous species was the rarest among the three introduced *Sonchus* species, S. *oleraceus* was the most frequent, mostly on open lots and margins, in small colonies or as unicates (8). Naturalized. Eurasia.

Sonchus asper (L.) Hill

Widespread, locally rare, observed 34 times. The colonies of it were especially small, often two or three specimens, and unicates were much more frequent (14) than in the other *Sonchus* species. Naturalized. Eurasia.

Lactuca serriola L. (*L. scariola* L.)

Widespread, locally frequent. It is a gregarious plant. No unicates were ever noticed, only colonies, which varied vastly in size. Naturalized. Eurasia.

Lactuca saligna L.

M 1071A, 8 Sep. 1956, 1 specimen. *M 3382*, 23 Aug. 1970, 1 specimen, also observed 14 June 1970 through Sep., 1 plant. No trace of it was found the next year. Eurasia.

Crepis pulchra L.

M 1453, 5 July 1958, 1 specimen. *M 1634*, 11 June 1960, 2 specimens; *M 1754*, 28 May 1961, 1 specimen, also observed in June. Although it seemed that *C. pulchra* had a good chance to persist, it disappeared without being exposed to any obvious danger of any kind, and it has not been observed since 1962. Eurasia.

Crepis tectorum L.

M 1807, 4 July 1961, 1 specimen (US). Eurasia.

DISCUSSION

Altogether 393 species were recorded (Table 3) in this study. Besides these, 53 infraspecific taxa were recorded. In 30 cases they were the only form of the species. In a few cases where a species was known to have a native and an introduced infraspecific taxon they were considered to be species for the statistical summary. In 23 cases 2 or even 3 introduced infraspecific taxa could be distinguished (1 subspecies, 13 varieties, 9 forms). Only one, mostly the prevalent or typical, was considered for the statistical accounts.

One question which arises is whether the synanthropic flora of the railroads in St. Louis is rich or poor? Although it might seem that this question could easily be answered by a comparison with the findings of European adventive botanists, there is in fact very often no common basis for comparison. Previously published studies differ vastly in the length of time of the study, coverage of localities, inclusion of certain categories of plants, such as egasiophygophytes, archaeophytes, or doubtfully determined species. Furthermore, each additional year of observation may add new species.

Perhaps the best comparison can be made with the thorough 6-year investigation of the railroad station Zürich by Thellung (1905). Its geographical site, far away from oceans, is common with that of St. Louis. Altogether he recorded 451 introduced plants. One of the subgroups, the ergasiophygophytes is directly comparable in both places. In Zürich their percentage was 23.1%, in St. Louis 35.6% (138 species). This difference is at least partly explicable by inclusion in St. Louis of species of such genera as *Bromus*, *Festuca*, *Dactylis*, *Lolium*, *Phleum*, *Trifolium*, *Melilotus* into the ergasiophygophytes.

The richest adventive floras have been associated with seaports or inland harbors. The 800 species in 100 years in Montpellier (Thellung, 1912) has been the highest recorded number. In the United States Reed (1964) was able to discover 536 species during 10 years on chrome and manganese ore piles near Baltimore and Newport News, Virginia. In the famous Tweedside adventive flora (Hayward & Druce, 1919) 348 species were counted during 11 years. In Karlsruhe, Jauch (1938) was able to collect 247 species in 5 years (including some natives). Against this background the synanthropic railroad flora in St. Louis can be considered to be well developed, but more or less average.

The actual number of railroad synanthropes in St. Louis must be much higher than the reported 393 species. Thellung (1915) already cautioned that the investigation of an adventive flora is wholly based on chance. Lademann (1937) noted, after publishing a list of adventives in the Lusatia region in Germany, that the number of the adventives really occurring in the region was not nearly exhausted and that many a species had certainly evaded observation. These thoughts are frequently repeated in one or another way by many other botanists. There is no doubt that this statement is completely valid for St. Louis also. The best evidence is the high number of unicates (52) and single solitary colonies (75) found. This clearly means that many spots with unseen plants could simply have been missed.

In the following paragraphs some statistical data about the synanthropes are presented. First is the number in each of the eight regions.

The species were distributed in the regions as follows:

I: 274 II: 217 III: 195 IV: 152
V: 210 VI: 145 VII: 120 VIII: 149

The next comparison shows in how many regions the species occurred: 150 species occurred in only 1 region, 43 occurred in 2 regions, 26 occurred in 3 regions, 34 occurred in 4 regions, 19 occurred in 5 regions, 13 occurred in 6 regions, 28 occurred in 7 regions, and 80 occurred in 8 regions.

The majority of species were either widespread, occurring in all eight regions, or restricted and concentrated in only one region.

Frequency is demonstrated by the following: common 11, frequent 37, scattered 67, rare 70, very rare 208.

As mentioned before, the frequency categories were largely subjective, and because of the often great fluctuations in the number of synanthropes from year to year, it was often difficult to classify a particular species in a frequency category.

A group among the very rare plants merits special mention, namely, those which were seen only once. They were found either as unicates (47 species) or growing in a single colony of various sizes (52 species; 9 times, only 2 speciments were counted). Thus exactly one quarter of all the recorded synanthropes were seen only once. Further, 28 species (5 unicates and 23 colonies) were persistent, reappearing on the same spot repeatedly, 18 (7 unicates and 11 colonies) of them being woody species. Deducting the woody species, the survival of which is much more certain, unicates (45 species) persisted only twice (4%). On the other hand, plants growing in solitary (single) colonies (64 species) managed to survive in 15 cases (23%) for at least two years, and some for a decade and more. One should not forget that the unicates were victims of collecting. But in cases where only parts of a unicate were taken the results were no better. Therefore it is possible that the prospect for an introduced plant is much more favorable when its diaspores arrive simultaneously in quantities, thereby enabling it to create a colony immediately.

Many of the 393 synanthropes were novelties to the flora of Missouri. Until now 35 species and 4 infraspecific taxa had not been recorded previously. Altogether I added 129 new synanthropic taxa to the flora of Missouri (114 species, 1 subspecies, 11 varieties and 3 forms). The older data were reported in previous papers (Mühlenbach, 1957, 1960, 1969b) and in the *Flora of Missouri* by Steyermark (1963).

As have many adventive botanists, I analyzed the longevity of the synanthropes. As is usually done, biennials were combined with annuals. Calculation was not quite exact because in quite a few cases there are varying statements in the literature about the longevity of the plants in question. One plant is even described as "annual herb or perennial subshrub." For those plants the longer life span was used. Among 393 species, 254 were annuals, 107 perennials, 32 woody. These figures correspond fully with numerous European findings in the prevalence of annuals. The number of woody species in St. Louis seem somewhat higher than has usually been reported. The overwhelming majority of these woody species were ergasiophygophytes and, as this group was stressed in the field work, their representation may have been unusually high.

Statistics also reveal the botanical importance of single freight yards. The common plants were not especially suitable for this purpose, of course; therefore, only the very rare plants (208 species) were used for this analysis. Among the 30 freight yards, the highest yields were as follows: Carrie Ave. (RI) 37, Baden (MKT) 31, Lesperance St. (MP) 28, St. Louis Ave. (N&W) 25, North St. Louis (BN) 22, Lindenwood (SL-SF) 16. Of these same very rare plants, 116 species occurred in yards only, 50 occurred only along trunk lines, and 42 occurred in both places.

The 393 synanthropes belonged to 59 families, 28 of which were represented by only one species. The six families with the greatest number of species were Gramineae 74, Compositae 52, Cruciferae 28, Leguminosae 27, Caryophyllaceae 19, Polygonaceae 16.

The frequency of families in the various published adventive floras vary considerably, but the six families just enumerated, plus the Labiatae, are usually best represented. The Leguminosae frequently play a much more prominent role than in St. Louis, particularly when the introductions proceed chiefly from the Mediterranean region.

The most common genera in St. Louis were *Bromus*, *Eragrostis*, and *Polygonum* with 8 species each, and *Rumex*, *Chenopodium*, *Amaranthus*, *Silene*, and *Centaurea* with 7 species each.

Although authors differ quite often in the evaluation of the origin of many synanthropes, a summary shows that almost two-thirds of the St. Louis synanthropes are of European and/or Asian origin (Eurasian 180, European 44, Asian 39). Fifty-seven species are North American, 23 South American, 4 African, and 1 Australian. Three have a pantropic distribution and two, palaeotropic. The rest (40) are cultigens, many of them with uncertain provenances. Their number is much smaller than previously given. Omitted are some grasses, *Melilotus*, *Trifolium* sp., etc., when the introduction, rather than escape from cultivation, was most probable. The North American species originate for the most part in the western or southern part of the U.S. None are from the north —a situation often observed in European studies also. There is little doubt that the overwhelming majority of these synanthropes did not come here directly from their lands of origin, but stage by stage from intermediate stations. Only in the case of North American species was a direct introduction conceivable. Among the arrivals from other continents, only *Centaurea diluta* was possibly a direct introduction via California, as explained in the discussion of this species in the systematic part of this paper.

The overwhelming majority of the 393 recorded plants not native to Missouri flora are weeds. The definitions of the term "weed" have been numerous. Perhaps the most appropriate is that of Fogg (1945): "Any plant which grows where it is not wanted." Hardly another habitat will shelter so many weeds as railroad premises, although some ruderal places and dumps might come close.

It is of interest to compare the St. Louis railroad weeds with those of Missouri. Drew & Helm (1941) compiled a list of 154 representative Missouri weeds. They considered 135 species of primary and 19 of secondary importance. Of those 154 species, 79 were native and 75 adventive to Missouri. Of these 154 weeds, 146 were encountered at least once during this entire study of the railroads, only 8 were not seen. Three among these unseen species are introductions—*Lolium temulentum* L., *Stellaria graminea* L. and *Solanum dulcamara* L. Drew. Helm's list also contains *Solanum nigrum* L. (an introduced species), but there can be little doubt that the plant in question is actually the native *Solanum americanum* Mill. *Solanum nigrum* is neither mentioned in the *Flora of Missouri* nor has it been collected by me.

Some weeds are recognized as especially damaging to agriculture. The

Missouri seed law and regulations issued by the Missouri Department of Agriculture (1957, 1966) regulate the amount of so-called noxious weed seeds permitted in "agricultural seeds" of cultigens for sale. Altogether 15 weeds have been declared as noxious. With one exception (*Euphorbia esula* L.), they have been found on the railroads in St. Louis, many of them growing quite abundantly. Moreover four other species are classified as "prohibited weed seeds." These should never be present in any kind of agricultural seed that is for sale. Three of these are common on the railroads; only *Sorghum almum* Parodi has not been found.

The fate of the synanthropes on a railroad is usually dismal. For the most part they are doomed. An entire range of factors is implicated in this. Foremost is the reckless destruction by man.

The widespread use of weed killers is currently the strongest destructive influence. Track repairs, reconstruction, and relocation are also usually detrimental to railroad plants. The Luther Freight Yard (N&W) has been modernized to such an extent that except for some margins, practically nothing remains of the old yard. The O'Fallon Freight Yard with its interesting synanthropic flora was simply liquidated, sold, and converted into a parking lot. Similar examples could be multiplied. Accidents and frequent spills of oils and similar substances also often destroy railroad plants.

Of further great importance is the competition of the native plants and adverse climatic conditions. Climatic conditions in most cases decide whether an introduced plant will be able to reproduce. If synanthropes originate in warm regions, they may be unable to mature fruits in the shorter growing seasons. In other cases the ripened fruits cannot survive long, humid autumns and decay. In other cases prematurely germinating seed may be killed by frequent spring frosts. In numerous places the ground on the railroad is barren, and many plants may be unable to grow simply for this reason. However, it is also striking that many rarities which flower and ripen fruits before the close of the season and which grow in very remote, secure areas nevertheless vanish the following year. It seems that these circumstances work very selectively in the introduction process. With regular freight traffic many species are introduced again and again, but many never persist because they cannot adapt to the rigors of a railroad environment. For this reason, the number of introduced species should be much higher than it is in reality.

Plants which more easily adapt to altered climatic conditions and poor soils, which are stronger in competition with other plants, and which better tolerate damages become established on railroads and may be able to expand into the surroundings. Because of this, it is possible to observe introduced plants which may be able to hold out in the same locality for successive years or decades. Such plants have attained persistence. Many adventive botanists like to speak in such cases of naturalization, an often premature designation. For example, a spill of lubricant killed a vigorous colony of *Kickxia elatine* which had persisted for 16 years, and the wreckage of a derailed freight train buried a colony of *Arctium minus.* But, as already mentioned by Polunin (1960), colonies of long standing have also disappeared when absolutely no reason was obvious.

Much has been written about naturalization. Many have emphasized that it is possible to speak about naturalization only if the plant in question has shown an ability to transfer to some natural habitat, thereby proving that it is able to compete against the native plants, as well as having adapted to the climatic and edaphic conditions of its new homeland. It must be able to reproduce normally, without any assistance of man, be it by seed production or by vegetative means. Thellung (1915) also demanded that such plants be able to successfully outlive any climatic abnormality.

I confined my observations to the railroad premises, so that I have no personal observations of whether some synanthropes have gained a firm footing in natural habitats around the city and how they thrive there.

It is impossible to speak about natural habitats on the railroads themselves. During short periods of time small areas were relatively undisturbed, but these dwindled rapidly in number during the course of this study. For the most part the railroad premises border onto the built-up areas of the city. Extensive sections of the tracks run along the Mississippi River, but on the often narrow strip between the tracks and river bank no natural habitats remain. So the question of the naturalization had to be decided by observations on the railroads only, and it is on this basis that I have ventured statements on the eventual naturalization of synanthropes on the railroads in St. Louis. Two factors were decisive in my approach to naturalization. Scholz (1961) in his investigation of the ruderal flora in Berlin also spoke about naturalization, although very few natural habitats exist in a metropolis of this kind. He defined naturalized species to be those whose future extermination by man appears unlikely. For example, one species —*Sisymbrium irio* L.—persisted in Berlin on a very limited spot for 100 years, without expanding at all into its nearest surroundings. The neighborhood had suffered dreadfully during the war from the Allied bombing; however, the plant survived. Scholz noted that no great imagination would be needed to predict what would take place when the region, still partly in ruins at the time, was to rebuild. *Sisymbrium irio* would be completely finished. Such naturalization, as accepted by Scholz, is quite analogous with the situation on the railroad in St. Louis.

The second factor which encouraged me to speculate on this question is the existence of the modern *Flora of Missouri* by Steyermark (1963). While on the railroads all things may happen, in Missouri on the whole a common or frequent plant would be hardly exterminated, especially if it is widely dispersed. Steyermark rarely used the expression "naturalized" or its equivalent, "established." The most common definition about the distribution in Missouri was "throughout the state" or "throughout Missouri." The maps clearly depict the presence or absence in Missouri of every recorded plant in each of its 114 counties. Among the 89 species which I considered as naturalized, only 9 could be considered to be rarities, according to the *Flora of Missouri.* They are reported from five counties or fewer. However, all of them are doing fine on the railroads.

The judgment on naturalization was based on frequency, size of colonies, persistence in the same sites, number of years observed, location (margins are the safest places in the yards), and so on. Moreover, the estimate of frequency and naturalization was independently repeated several times and the results compared. In most cases, naturalization could be taken for granted, but for some the determination was less certain. Altogether 89 species were classified as naturalized. The 89 naturalized species occurred in the eight regions as follows: 65 species occurred in 8 regions, 16 in 7 regions, 3 in 6 regions, 2 in 5 regions, 2 in 4 regions, and 1 in 2 regions.

The frequency of the naturalized species was as follows: common 11, frequent 32, scattered 42, rare 3, very rare 1.

The fact that the naturalized plants were widespread for 65 species and quite widespread for 16 species supports the idea that the respective species will survive permanently. In only a few cases were the naturalized plants more or less limited to a few regions, within which they were constantly abundant (especially *Apera spica-venti, Verbesina encelioides*). Only one species—*Dipsacus sylvestris*—was classified as a naturalized plant on the basis of a single, but huge, colony.

In a few cases naturalization may be mimicked when a plant that is unable to reproduce in its place of introduction is regularly brought in year after year. However, such a process of pseudonaturalization, although reported in the European literature [see Thellung (1918–1919) for the classical example of *Guizotia abyssinica* (L.f.) Cass.], seems to occur only with *Triticum aestivum* in St. Louis.

So-called trivialization has been observed in St. Louis. Thellung (1915) studied the changes which occur in the vegetation of artificial habitats after these habitats are no longer used. As a rule, synanthropes are overrun by native species and simply disappear, beginning with the annuals. This process was called trivialization by Thellung (1915). It was also observed and studied by Messenger (1968) on abandoned tracks and freight yards in England. In St. Louis both Ranken yards, originally used for holding yards for passenger trains, were abandoned. Many rarities, repeatedly found in these yards during their use, vanished after their abandonment.

It would, of course, be of interest to compare the St. Louis results with those for the other localities in the United States, but no published reports are known to me. However, H. H. Iltis (1965) kindly supplied a list of plants observed in Madison, Wisconsin, on the Illinois Central Railroad right-of-way, Mills and Spring Streets. The list contains 63 species, most of Old World origin. With three exceptions [two adventives, *Solanum dulcamara* L., *Hesperis matronalis* L. and one native, *Parthenocissus vitacea* (Knerr) Hitchc.] all were found in St. Louis also. This list confirms the opinion frequently expressed in Europe that there are plants which are especially fit for introduction and which appear in numerous places time and again. For example Kreh (1960) noted that species observed in Innsbruck (Austria) and Lucerne (Switzerland) also grow in Stuttgart. Furthermore, St. Louis (393) and Riga (128) have 45 synanthropes in common.

The yearly fluctuations in the number of species, as well as specimens, so frequently emphasized in Europe (Runge, 1965) was also observed in St. Louis. The following numbers illustrate this: From 1954 through 1960, 56 species had been seen that were never again seen. From 1965 through 1971, 61 species appeared that had previously never been seen. Several examples of "population explosions" were observed. During the last years of this study *Chorispora tenella* and *Chaenorrhinum minus*, which had been rarities until then, developed huge colonies. It is premature to speculate about their fate, but the fact itself is noteworthy. One introduced grass, *Apera spica-venti*, as noted in the systematic section, behaved similarly, as did the native grasses, *Muhlenbergia asperifolia* (Nees & Meyen) Parodi and *Chloris verticillata* Nutt. (see below).

The opposite phenomenon—colonies persisting for years suddenly disappearing without apparent reason—was also observed and has also been frequently mentioned in European literature. One of the most striking examples was that of *Linaria vulgaris*, which grew in a very secure locality for eight years and then suddenly vanished. Also there is no doubt that during the years several scattered and rare species, e.g., *Agrostemma githago*, *Lepidium campestre*, *Solanum rostratum* and others, have become rarer than in the beginning. Sometimes the size of a colony may fluctuate considerably during the years. For example, *Centaurea diffusa*, which persisted for 11 years, produced from two specimens to quite large colonies from year to year.

Seed dormancy, which was already noticed by Brown (1880) in New York City's harbor, was observed in St. Louis also, especially in *Gaura sinuata*. Possibly seed dormancy is not at all a unique occurrence, but on railroads one normally must count on reintroductions, rather than seed dormancy. Very curious was the unexplained absence of *Potentilla argentea* for one year. It being a perennial, seed dormancy could not play any role.

The nanism of many synanthropes, which was especially stressed by Meyer (1931) and Brenan (1947), was also observed. Indeed, dwarfed forms of numerous species were common in St. Louis, and in this connection the name *Ammi majus* is a misnomer for specimens of this species collected on the St. Louis railroads.

As mentioned before, weed killing has had disastrous effects on railroad vegetation everywhere. The battle against vegetation on the railroads is almost as old as the railroads themselves. The reasons are manifold. It is carried out to improve the drainage of the tracks, to enable inspection of ties, fastenings, and switches, to prevent wheel slippage, to ease fire hazards, to facilitate the railroadmen's walking, to facilitate track maintenance and, to improve appearance. In addition there are laws concerning noxious weeds. The mechanical removal of plant cover prevailed in Europe until World War I. Quite popular in America was burning, which is now prohibited. The third possibility is to spray weed-killing chemicals. This began after World War I and gradually became more important. In the middle 1950s the application of weed-killing chemicals in St. Louis was already in use, although in some yards this practice was minimal, if even performed at all. When I began my work, the vegetation in the yards was usually largely unaffected. The increasing use of chemicals and its increasingly destructive effect on vegetation in St. Louis railroads has already been noted by me (Mühlenbach, 1957, 1969b). Since that time, the situation has become worse. Such places as the classification tracks of the large freight yards which initially yielded so many rarities are mostly bare of vegetation now. One interesting observation was made on *Eclipta alba*. In the 1960s it grew abundantly along the classification tracks in the Carrie Ave. Freight Yard. After spraying it was undamaged while all other plants perished. It seems possible that lack of competition helped greatly in its spread. However, later it also disappeared, succumbing to some newer and more powerful weed killer. Survivors of spraying often show marked morphological changes making determinations often difficult. This was also observed by Kreh (1960), who considered the misshapen plants to be of interest to teratology.

Another trend, also observed in Riga, was quite marked. There are species which appear only as colonies. These may sometimes be quite dense, as with *Cardaria draba*. It is a perennial and the colonies might be easily created in course of time by subterranean rhizomes. However, such colonies also occur among annuals and biennials. Especially striking were the colonies of *Arabidopsis thaliana*. Not so compact are colonies of *Torilis arvensis*, *Pastinaca sativa*, *Lamium amplexicaule*, *L. purpureum*, *Plantago lanceolata*, *Anthemis cotula*, and *Lactuca serriola*. Gregariousness is very obvious, although these species may sometimes also appear as dispersed specimens. Some large and well-established colonies show very little tendency to expand. The large colonies of *Dipsacus sylvestris* and *Verbesina enceloides* were good examples. The tendency of several rare species to appear as single specimens has previously been noted. More than a dozen species could be enumerated, but a few examples will suffice. *Sisymbrium loeselii* was met 11 times, and 10 times it was a unicate. For *Lappula echinata* the numbers were 21 and 17, respectively; for *Eupatorium capillifolium*, 6 and 5. Finally some species are now and then found widely dispersed over a whole yard, mostly as single or a few specimens. Examples are *Silene noctiflora* and *Camelina microcarpa*.

Many European adventive botanists have emphasized that the clarification of the question of how the adventives arrived must be considered of utmost importance. What was the vehicle or agent which brought them in? They speak about citrus weeds, grain, bird seed, cotton, and wool adventives, and so forth. Besides a few obvious cases of plants introduced with vegetables and fruits through the St. Louis Produce Market and plants introduced with grain in the vicinity of grain elevators, no such exact sources could be pinpointed in this study.

In Europe certain plants have been identified as migrant plants (Scheuermann, 1930), plants that may not only be brought in on freight but that can also spread by natural means along suitable railroad sites. These were called ferroviatic migrants by Domin (1947). Very clear examples have been given in Denmark by Pedersen (1955). Perhaps the best known species in this connection is *Eragrostris minor* (Galenieks, 1953–1959). However, clear examples have not been discovered in St. Louis.

The question of immigrant plants—those which are actively dispersing themselves independently of railroads—has not been settled in my study. Such immigrant plants must from time to time cross railroads and gain a foothold there. Among the aliens in St. Louis, some are probably immigrants. However, it is not easy to identify these with certainty without thorough data throughout a very large geographical area, not only the railroads. Certainly nothing like the explosive spread in Europe of *Senecio vernalis* Waldst. & Kit. (Ascherson, 1862) or the sudden dispersal of S. *tubicaulis* Mansf. to the polders of the Ijsel Meer in Holland (Schroeder, 1969) has been documented. Plants such as *Setaria faberi* and *Viola kitaibeliana* which are said by Steyermark (1963) to be actively spreading in Missouri might be considered migrant plants, but detailed information is lacking.

Scheuermann and many others simply ignored classification tracks in railroad yards, concentrating their attention primarily on unloading sites, warehouses, etc. They did not expect to find truly introduced adventives on classification tracks. My experiences led me to opposite conclusions. It is unthinkable that all the plants I found along classification tracks were only migrants. Where would they have migrated from and what long distances would they have to traverse in order to produce the frequently observed unicates? The whole procedure on classification tracks (as described previously) seems to be well adapted for the ready dispersal of the hitchhiking diaspores, and, consequently, the importance of the classification tracks for adventive botany remains high. They have had a major part in the dispersal of synanthropes in the past. At the same time, the current emphasis on chemical weed killing ensures that arriving diaspores have little chance of survival. Although the switching work is the same as it was 20 years ago, the results from the botanical point of view are now, as a result, nearly nil.

The unusual and sudden appearance of certain plants in several widely separate localities in certain years which were afterward never seen again is an interesting but unexplained phenomenon. This happened with the introduced *Galeopsis tetrahit* in 1956, *Ranunculus sardous* in 1970, and with the native *Senecio glabellus* in 1961. The most remarkable occurrence of this phenomenon was observed for the native *Senecio glabellus* Poir. The genus *Senecio* is very rare in St. Louis and so each observation immediately attracted attention. This species was discovered on May 20 through 28, 1961, in six localities in three regions. In all localities only a single dwarf specimen was found. Not a single specimen was ever found again.

Another notable phenomenon was frequent joint occurrence of species pairs such as *Sida spinosa* and *Abutilon theophrasti*, *Trifolium pratense* and *T. repens*, and *Salsola collina* and *S. kali*.

This work pinpointed some taxonomic problems. In the case of *Artemisia vulgaris* and *Chenopodium glaucum* three and two varieties, respectively, were identified from a few plants collected in nearly the same location. In cases such as this it seems very unlikely that distinct infraspecific taxa could appear simultaneously as synanthropes. An incorrect evaluation of taxonomic status seems more likely.

Altogether 476 native species were collected during this study. Many were common but quite a few were rarities. Undoubtedly many more existed, as some frequently encountered plants such as *Platanus occidentalis* L. were not collected, and undetermined collections were also not counted. A certain number must also have been overlooked. One noteworthy observation is that many native plants were observed only as single colonies (65) or even as unicates (25). Only a few of the 65 colonies survived in the same spot through the years. It is my firm conviction that many of these native plants in freight yards were introductions like the true synanthropes. Many were conspicuous [e.g., *Boerhaavia erecta* L., *Asclepias tuberosa* L., *Liathris pycnostachya* Michx., *Astranthium integrifolium* (Michx.) Nutt.]. They were all found in much frequented areas, and in the terminology of Thellung must be considered to be apophytes. Seed dormancy could be assumed in at least one case. *Schrankia nuttallii* (DC.) Standley suddenly appeared along old cleanout tracks abandoned for several years in the Baden Freight Yard. Or did it, as well as many other species, appear here by introduction or by ferroviatic migration? This question cannot be answered directly. That natives of Missouri can be introduced in St. Louis by traffic is clearly seen in Steyermark's *Flora of Missouri*. He cited a long series of species with widely separated localities from different parts of the state. No intermediate stations were known. This indicates that we are dealing with introductions, not with ferroviatic migration. The following 14 species were plants native to some parts of Missouri, but considered by Steyermark (1963) to be introductions in St. Louis. Almost all originate in the western and/or southern parts of the state, quite a few being more or less restricted to the loess mounds of the most northwestern counties. They all are apophytes in the sense of Thellung.

1. *Sporobolus cryptandrus* (Torr.) Gray. Quite widespread, locally scattered.

2. *Chloris verticillata* Nutt. Three colonies were observed in Regions 1 and 8. Two of them persisted for some years—1959–1966 in the North St. Louis Yard, 1966–1971 in the Baden Yard. Quite unexpectedly a rapid spread occurred in South St. Louis, especially in the vicinity of the Christy Park from 1966 to 1972, and this grass has now spread rather widely in the city. It is likely to become a pest in the future. The entire mature inflorescence breaks off and is blown around like a tumbleweed. The grass was first encountered as a tumbleweed in Region 4, but a careful search of the surroundings revealed nothing. It is clear that the tumbleweeds of this species may travel quickly and far. It is worthwhile to mention that the dead end of the tracks of the MP Christy Lead, serving the Christy Works Refractories Division of the H. K. Parker Company and its underground clay mines, approached Christy Park within 100 m. The works were demolished and the tracks were dismantled in 1969; but it is of course impossible to say whether the phenomenal spread of *Chloris verticillata* was brought about by a railroad introduction.

3. *Andropogon saccharoides* Swartz. At least 8 colonies were observed in Regions 1 and 5, most of them persistent. One was observed from 1954 to 1971.

4. *Scirpus divaricatus* Ell. Only one collection was made: *M 980*, 1 July 1956.

5. *Portulaca mundula* Johnston. *M 1116*, 7 Oct. 1956, and again seen 4 Aug. 1963.

6. *Cleome serrulata* Pursh. Unicate, but collected piecemeal three times *M 1790*, 1 July 1961; *M 1838*, *M1806*, 29 July 1961; *M 1838*, 9 Sep. 1961.

7. *Ribes odoratum* Wendland f. *M 1365*, 1 shrub, 14 Sep. 1957.

8. *Liquidambar styraciflua* L. Four localities in Regions 1 and 6. Mostly in shrubbery accompanying the tracks. Ripe fruits and quite low juvenile shrubs were seen.

9. *Trifolium carolinianum* Michx. *M 195*, 27 June 1954, unicate.

10. *Euphorbia marginata* Pursh. Scattered in 6 regions, in quite a few places persistent. Steyermark (1963) considered it as escaped from plantings in gardens. Along the railroads in St. Louis many localities were far away from gardens.

11. *Passiflora incarnata* L. Three locations in Regions 2 and 8, forming small colonies. It persisted in one locality from 1966 to 1971, although it could not be found in 1967.

12. *Gaura coccinea* Pursh. *M 632*, 18 June 1955, unicate. *M 1605*, 15 May 1960, 1 colony; *M 1640*, 18 June 1960; *M 1737*, 21 May 1961.

13. *Cynosciadium pinnatum* DC. *M 938*, 16 June 1956, 4 specimens.

14. *Iva xanthifolia* Willd. Observed seldom in 4 regions (1–3, 5) with a pronounced tendency to appear as unicates (10). The height was ordinarily low.

There is no doubt that the great majority of the synanthropes is introduced by the cargo of freight trains, but in rare cases the freight cars themselves are vehicles for hitchhiking diaspores (Zimmermann, 1907; Pedersen, 1955; Hugentobler, 1961). In 1974 I confirmed this after examining various freight cars. Seeds were collected from the sticky layer of lubricants which usually covers the lubricating cups of wheels. In three hours perhaps 30 seeds were collected. Most seeds were anemophilous, most probably of the composite family. Frequently only the pappus was collected, the achenes beng already detached. Grass spikelets were also collected, although some were disintegrated. Freight cars have several cavities or pockets, where something unusual may also be found. Some totally dried ligneous branches, a piece of a corn cob, some grain seeds, and other fragments of plants were removed. Seeds were also found in the runners of sliding doors. These seeds were found primarily on box cars but also on hoppers and flat cars. Of course, these seeds could not be considered sure introductions. They could as well have been picked up in St. Louis; however, the potential clearly exists. Such seeds can drop off the cars due to vibration (Pedersen, 1955) or during cleaning or lubrication. Whether contact with lubricants would suppress germination is not known.

It was obvious that almost all seeds were found on the car trucks of the older type. Just as with the development of the weed killers, introduction of the so-called roller bearings on new railroad cars has also diminished the chance of dispersal of plants by the railroads.

Railroad workers themselves may also play a major role in the dispersal of plants on the railroads. This may be demonstrated in two ways. From time to time plants never seen before (*Chaerophyllum tainturieri* Hook., *Verbena urticifolia* L., *Specularia perfoliata* (L.) A. DC., *Solidago* sp., *Erigeron strigosus* Muhl., *Rudbeckia hirta* L.) suddenly appeared in my backyard. Most of these plants are frequently encountered on the railroads. I often found different seeds and fruits in abundance in the cuffs of my trousers or attached to my socks after excursions. Perhaps the most frequent were the spikelets of *Bromus tectorum*, brought home now and then in large amounts in the early summer. More annoying were *Setaria verticillata*, *Galium aparine* and different *Desmodium* and *Bidens* species. Quite seldom fruits of *Cenchrus longispinus* (Hack.) Fern., *Tribulus terrestris* L. and *Xanthium strumarium* L. may be attached to clothing.

It is likely that all were effectively dispersed from the railroad on my clothing. Therefore it seemed logical as the next step to investigate the cuffs of a switching crew, who spent long times outdoors in a railroad yard. In the North St. Louis Freight Yard many seeds and fruits were indeed found after such an examination in 1974. The probability seems great that the railroadmen participate effectively in the dispersal of plants in freight yards. This has been called epianthropochory (Faliński, 1972). It is especially credible when rare plants are spread over a whole yard as many isolated specimens.

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